

PLATING OF SUBSTRATE AND APPARATUS THEREFOR

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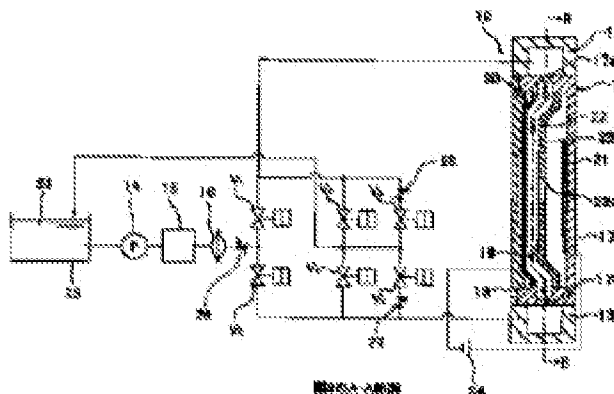
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Abstract of JP11335895

PROBLEM TO BE SOLVED: To provide a method for plating a substrate which allows the easy escape of air bubbles from microholes in the plating surface of the substrate to be plated, is capable of forming a plating film of a uniform film thickness on the plating surface of the substrate to be plated and substantially prevents the deposition of particles, or the like, within the plating vessel and an apparatus therefor. **SOLUTION:** This plating apparatus 10 is installed with the substrate 19 to be plated in the hermetically closed plating vessel 11 and the substrate 19 to be plated is fixed by the plating vessel 11. The plating is applied on the surface of the substrate 19 to be plated by introducing a plating liquid 23 into the plating vessel 11. The apparatus is provided with a means for vertically erecting or inclining the surface of the substrate 19 to be plated and executes the plating in the state of vertically erecting or inclining the substrate 19 to be plated. The plating liquid 23 is made to flow in parallel with respect to the surface of the substrate 19 to be plated and is made to flow in a backward direction at a prescribed timing.



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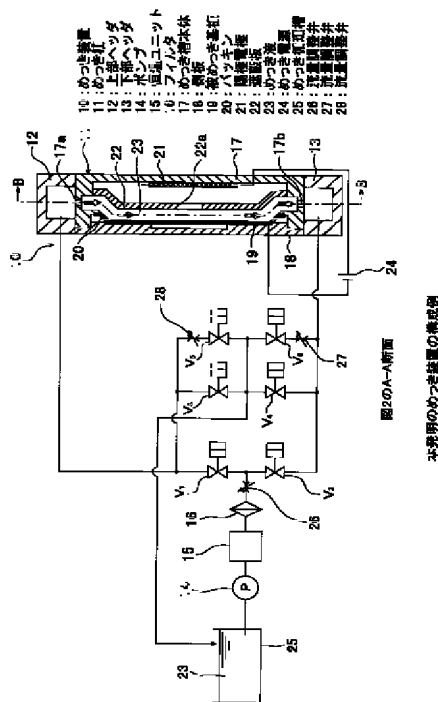
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(54) 【発明の名称】 基板のめっき方法及び装置

(57) 【要約】

【課題】 被めっき基板のめっき面の微細穴の気泡が逃げやすく、被めっき基板のめっき面に均一な膜厚のめっき膜が形成でき、且つめっき槽内にパーティクル等が堆積しにくい基板のめっき方法及び装置を提供すること。

【解決手段】 密閉されためっき槽11内に被めっき基板19を設置すると共に該被めっき基板19はめっき槽11によって固定され、該めっき槽11内にめっき液23を導入して被めっき基板19面上にめっきを施すめっき装置10において、被めっき基板面を鉛直又は傾斜させる手段を設け、該被めっき基板19を鉛直又は傾斜させた状態でめっきを行う。また、めっき液を被めっき基板表面に対して平行に流す。また、めっき液を被めっき基板表面に対して平行に流すと共に、所定のタイミングで逆方向に流す。



【特許請求の範囲】

【請求項1】 密閉されためっき槽の中に被めっき基板を収容し、該めっき槽内にめっき液を導入して前記被めっき基板のめっき面上にめっきを施す基板のめっき方法であって、

前記めっき液の圧力を変動させ、且つ該めっき液の流れ方向を切換えつつ、めっきを行うことを特徴とする基板のめっき方法。

【請求項2】 密閉されためっき槽の中に被めっき基板を収容し、該めっき槽内にめっき液を導入して前記被めっき基板のめっき面上にめっきを施す基板のめっき装置であって、前記めっき液が前記被めっき基板のめっき面に平行に流れるように、その流路が形成されていることを特徴とする基板のめっき装置。

【請求項3】 密閉されためっき槽の中に被めっき基板を収容し、該めっき槽内にめっき液を導入して前記被めっき基板のめっき面上にめっきを施す基板のめっき装置であって、前記被めっき基板のめっき面が、鉛直面に対して傾いた姿勢で保持されるように構成されていることを特徴とする基板のめっき装置。

【請求項4】 請求項2に記載の基板のめっき装置において、前記被めっき基板のめっき面を鉛直から30°の範囲で上を向くように傾斜させる手段を設け、該被めっき基板をこの範囲で傾斜させた状態でめっきを行うことを特徴とする基板のめっき装置。

【請求項5】 請求項2乃至4のいずれか1項に記載の基板のめっき装置において、前記めっき槽はめっき槽本体と該めっき槽本体の開口部を開閉する側板とを具備し、該側板には基板を保持する保持機構が設けられると共に、該めっき槽本体の開閉部には環状のパッキンを設け、前記めっき槽本体の開口部を前記側板で閉じた状態で該側板に装着された被めっき基板の周縁面が前記パッキンに当接し、該めっき槽本体と該被めっき基板の間に前記めっき液を前記被めっき基板のめっき面に対して平行に流すめっき液流路を形成するように構成したことを特徴とする基板のめっき装置。

【請求項6】 請求項2乃至5のいずれか1項に記載の基板のめっき装置において、前記めっき槽には被めっき基板の装着を検出するセンサを設け、該センサの出力から被めっき基板が装着されていないと判断したとき、少なくとも前記めっき槽にめっき液を供給しないようにする手段を設けたことを特徴とする基板のめっき装置。

【発明の詳細な説明】**【0001】**

【発明の属する技術分野】本発明は半導体ウエハ等の被めっき基板のめっき面にめっき膜を形成する基板のめっき方法及び装置に関するものである。

【0002】

【従来の技術】従来、この種のめっき装置として図11に示す構成のものがある。このめっき装置はめっき槽101の外側に外槽102を配置した構成である。該めっき装置において、治具103に装着された被めっき基板104のめっき面を下向きにし、めっき槽101の下側から被めっき基板104のめっき面に向かって、めっき液105を流しめっきを行う。めっき槽101をオーバーフローしためっき液105はポンプ106により、恒温ユニット107、フィルタ108を通して、めっき槽101に送られ、循環するようになっている。

【0003】

【発明が解決しようとする課題】上記構成のめっき装置では、被めっき基板104のめっき面が下向きであるため、該めっき面の微細な穴や溝にめっき液を入れるには不利であり、特に穴径や溝幅が超微細になればなる程穴や溝中の気泡が逃げにくくなり、めっき液105が入り込みにくいという問題がある。更に、めっき液105の流れが被めっき基板104のめっき面に対して垂直方向の流れであるため、被めっき基板104の中央と外周ではめっき膜の厚さが異なり、めっき膜の膜厚が均一にならないという問題がある。この傾向が被めっき基板の径が大きくなれば大きくなる程顕著になるという問題があった。

【0004】被めっき基板104のめっき面の穴の気泡が逃げ易くするため、図12に示すように、被めっき基板104のめっき面を上向きにしためっき装置もあるが、この方式では、めっき槽110の壁面等に堆積するパーティクルが被めっき基板104のめっき面に付着しやすいという問題がある。なお、図12において、111は被めっき基板104を装着する治具、112はシール部である。

【0005】本発明は上述の点に鑑みてなされたもので、ウエハのめっき面の微細穴の気泡が逃げやすく、被めっき基板のめっき面に均一な膜厚のめっき膜が形成でき、且つめっき槽内にパーティクル等が堆積しにくいめっき装置を提供することを目的とする。

【0006】

【課題を解決するための手段】上記課題を解決するため請求項1に記載の発明は、密閉されためっき槽の中に被めっき基板を収容し、該めっき槽内にめっき液を導入して被めっき基板のめっき面上にめっきを施す基板のめっき方法であって、めっき液の圧力を変動させ、且つ該めっき液の流れ方向を切換えつつ、めっきを行うことを特徴とする。

【0007】上記のようにめっき液の圧力を変動させ、且つ該めっき液の流れ方向を切換えつつ、めっきを行う

ことにより、被めっき基板のめっき面に形成された微細な穴や溝からの気泡の抜け及び微細な穴や溝へのめっき液の入り込みが良くめっき欠陥がなく、より膜厚の均一なめっき膜を形成することが可能となる。

【0008】また、請求項2に記載の発明は、密閉されためっき槽の中に被めっき基板を収容し、該めっき槽内にめっき液を導入して被めっき基板のめっき面上にめっきを施す基板のめっき装置であって、めっき液が被めっき基板のめっき面に平行に流れるように、その流路が形成されていることを特徴とする。

【0009】上記のようにめっき液流路をめっき液が被めっき基板のめっき面に平行に流れるように形成することにより、被めっき基板のめっき面にその大きさに左右されることなく、膜厚の均一なめっき膜を形成することが可能となる。

【0010】また、請求項3に記載の発明は、密閉されためっき槽の中に被めっき基板を収容し、該めっき槽内にめっき液を導入して被めっき基板のめっき面上にめっきを施す基板のめっき装置であって、被めっき基板のめっき面が、鉛直面に対して傾いた姿勢で保持されるように構成されていることを特徴とする。

【0011】上記のように被めっき基板のめっき面が、鉛直面に対して傾いた姿勢で保持されるので、パーティクルがめっき面に付着することがない。

【0012】また、請求項4に記載の発明は、請求項2に記載の基板のめっき装置において、被めっき基板のめっき面を鉛直から30°の範囲で上を向くように傾斜させる手段を設け、該被めっき基板をこの範囲で傾斜させた状態でめっきを行うことを特徴とする。

【0013】上記のように被めっき基板面を鉛直から30°の範囲で上を向くように傾斜させる手段を設け、被めっき基板をこの範囲で傾斜させた状態でめっきを行うことにより、被めっき基板のめっき面の微細穴の気泡が容易に抜け、微細な穴や溝の内部までめっき液が流れ込み、その内壁面にもめっき膜が形成できる。また、パーティクルの被めっき基板のめっき面への付着もない。

【0014】また、請求項5に記載の発明は、請求項2乃至4のいずれか1項に記載の基板のめっき装置において、めっき槽はめっき槽本体と該めっき槽本体の開口部を開閉する側板とを具備し、該側板には基板を保持する保持機構が設けられると共に、該めっき槽本体の開閉部には環状のパッキンを設け、めっき槽本体の開口部を側板で閉じた状態で該側板に装着された被めっき基板の周縁面がパッキンに当接し、該めっき槽本体と該被めっき基板の間にめっき液を被めっき基板のめっき面に対して平行に流すめっき液流路を形成するように構成したことを特徴とする。

【0015】上記のようにめっき槽本体の開口部を側板で閉じた状態で該側板に装着された被めっき基板の周縁面がパッキンに当接し、該めっき槽本体と該被めっき基

板の間にめっき液を被めっき基板のめっき面に対して平行に流すめっき液流路を形成するので、被めっき基板のめっき槽本体の開口部に露出しためっき面にのみ平行に流れるめっき液が接触し、該めっき面以外の部分にはめっき液が接触してめっきが施される等の不都合がなく、且つめっき面のみに膜厚の均一なめっき膜を形成することが可能となる。

【0016】また、請求項6に記載の発明は、請求項2乃至5のいずれか1項に記載の基板のめっき装置において、めっき槽には被めっき基板の装着を検出するセンサを設け、該センサの出力から被めっき基板が装着されていないと判断したとき、少なくともめっき槽にめっき液を供給しないようにする手段を設けたことを特徴とする。

【0017】上記のようにセンサの出力から被めっき基板が装着されていないと判断したとき、めっき槽にめっき液を供給しないようにするので、被めっき基板が装着されていない状態でめっき液が供給されることにより発生するめっき液漏れ等の事故を防止することができる。

【0018】また、請求項2乃至6のいずれか1項に記載のめっき装置において、めっき槽本体には被めっき基板と対向し略中央部に電場調整用穴が形成された遮蔽板と陽極電極とが配置されており、該陽極電極を該遮蔽板の電場調整用穴に嵌合挿入し、該遮蔽板の面と該陽極電極の面が略同一の面で連続するように構成されたことを特徴とする。これにより、遮蔽板の面と陽極電極の面とウエハ面の間を流れるめっき液の流れに乱れが少なく、より均一なめっきが可能となる。

【0019】また、請求項2乃至6のいずれか1項に記載のめっき装置において、めっき液をめっき面に対して平行に流すと共に、所定のタイミングで逆方向に流す手段を設けたことを特徴とする。これにより膜厚の均一なめっき膜を形成することが可能となる。

【0020】また、請求項2乃至6のいずれか1項に記載のめっき装置において、所定のタイミングでめっき槽内の圧力を変動させる手段を設けたことを特徴とする。これにより、微細穴からの気泡の抜け及び微細穴のめっき液の入り込みが良く、より膜厚の均一なめっき膜を形成することが可能となる。

【0021】また、請求項2乃至6のいずれか1項に記載のめっき装置において、めっき工程後にめっき液を排出すると共に、代わりに水流水を流し、めっき面及び前記めっき槽内を水洗する手段を設けたことを特徴とする。これにより、パーティクルの生成は防止され、パーティクルによる悪影響を除去することができる。

【0022】また、上記めっき液の排出後又は水流水の排出後に水切りのための気体をめっき槽内に流す手段を設けたことを特徴とする。これにより、被めっき基板及びめっき槽内を乾燥させることができ、装置内の汚染が軽減され、且つ被めっき基板の表面が乾燥されるため、

パーティクルが付着しにくくなる。

【0023】

【発明の実施の形態】以下、本発明の実施の形態例を図面に基づいて説明する。図3は本発明の概念を説明するための図である。図3(a)に示すように、密閉されためっき槽(図示せず)内にめっき治具1に装着された半導体ウエハ等のめっきを施す被めっき基板2のめっき面を鉛直に設置し、めっき液3を下方から上方へ向かって、該めっき面に対して平行に流す。このように、密閉されためっき槽内でめっき液3が被めっき基板2のめっき面に平行に流れることで、めっきムラがなく、均一なめっき膜を形成できる。そして被めっき基板2を略鉛直方向に立てた状態とすることで、被めっき基板2のめっき面にめっき中にパーティクルが付着するという問題が防止される。

【0024】なお、パーティクル付着の防止は、図3(b)に示すように被めっき基板2を鉛直方向から傾けた状態としても達成できる。この効果は図3(b)においては被めっき基板2のめっき面が上向きの場合を示しているが、被めっき基板2のめっき面が下向きとなるように傾けた場合でも同様であることは勿論である。

【0025】更に、図3(b)に示すように被めっき基板2を鉛直面から傾斜させ、めっき面が上を向くようにすることにより、図3(c)に示すように、被めっき基板2の穴2aの気泡4が抜け易くなる。従って、図3(c)に示すように、被めっき基板2のめっき面を鉛直面から上向きに傾けることで、パーティクルが被めっき基板のめっき面に付着せず、更に、めっき液3を被めっき基板2のめっき面に平行に流すことで、被めっき基板2の大きさに左右されることなく、被めっき基板2のめっき面に均一な膜厚のめっき膜を形成することができる。

【0026】また、このめっき槽の特徴としては、密閉した空間内で、被めっき基板2のめっき面に平行にめっき液を流すものであるので、めっき液の圧力、流れ方向及び流速を任意に調整することが可能となる。これにより、微細な被めっき基板のめっき面に形成された溝や孔に、緻密にめっき膜を形成することができる。

【0027】図1は本発明のめっき装置の構成例を示す図である。図2はめっき槽の正断面(図1のB-B断面)を示す。被めっき装置10はめっき槽11と、上下に上部ヘッダ12、下部ヘッダ13と、ポンプ14、恒温ユニット15、フィルタ16を具備する構成である。めっき槽11は開口部を有する断面コ字状のめっき槽本体17と平板状の側板18からなり、該側板18には被めっき基板19を装着し、該側板18をめっき槽本体17の開口部に密着させて固定することにより、パッキン20が被めっき基板19の周縁部に密着して固定される。また、めっき槽本体17は平板状の陽極電極21が設けられている。被めっき基板19と陽極電極21は平

行に配置されている。なお、図1において、めっき槽11は図2のA-A断面を示す。

【0028】陽極電極21と被めっき基板19の間には誘電体板からなる遮蔽板22が配置され、該遮蔽板22の中央部には被めっき基板19のめっき面に対向して、穴22aが設けられている。なお、この穴22aは被めっき基板19のめっき面の電場を調整する作用を奏する電場調整用の穴である。また、被めっき基板19と遮蔽板22の間は平行な隙間が形成され、該隙間をめっき液23が流れることにより、めっき液23の流れが被めっき基板19のめっき面に対し平行に流れるようになっている。また、めっき液23の流路の幅bと長さcは被めっき基板19の径aより大きくになっている。また、めっき槽本体17の上下部にはめっき液が通る多数の穴17a及び穴17bが設けられる。また、陽極電極21と被めっき基板19の間にはめっき電源(直流電源)24から所定の電圧が印加されるようになっている。

【0029】上記構成のめっき装置10において、めっき槽11内にめっき液23を正方向に流す時は、弁V₁及び弁V₄を「開」にすると共に、弁V₂、弁V₃、弁V₅及び弁V₆を「閉」にする。めっき循環槽25内のめっき液23はポンプ14により、恒温ユニット15、フィルタ16、流量調整弁26及び弁V₁を経由して上部ヘッダ12に送られ、めっき槽11内を通過し、下部ヘッダ13及び弁V₄を経て再びめっき循環槽25に戻る。めっき槽11内ではめっき槽本体17の上部の穴17aを通過して、被めっき基板19と遮蔽板22の間の隙間を流れ、更にめっき槽本体17の下部の穴17bを通過して流れる。また、めっき電源24から所定の電圧を陽極電極21と被めっき基板19の間に印加する。

【0030】上記構成のめっき装置において、被めっき基板19はめっき槽11の側板18に固定されているから、めっき槽11を垂直又は傾斜させることにより、被めっき基板19は傾斜することになる。傾斜させる角度としては、0〜30°の範囲が好適であるが、これに限定されるものではない。従って、めっき面の微細な穴の気泡は容易に抜け、且つパーティクルの付着も無くなる。更に、めっき液23が被めっき基板19と遮蔽板22の間の隙間を流れると、めっき液23の流れは上記のように被めっき基板19のめっき面に対して平行な流れとなるから、被めっき基板19の大きさに左右されることなく、膜厚の均一なめっき膜を被めっき基板19のめっき面に形成できる。また、めっき液の流路の幅b及び長さcは被めっき基板19の径aより大きく形成されているので、めっき液の流れも被めっき基板19の全面で均一となり、膜厚の均一なめっき膜を被めっき基板19のめっき面に形成できる。

【0031】また、上記構成のめっき装置において、めっき槽11内のめっき液23の流れを所定のタイミングで逆転させる。即ち、弁V₂及び弁V₃を「開」にすると

共に、弁 V_1 、弁 V_4 、弁 V_5 及び弁 V_6 を「閉」にすることにより、めっき循環槽25内のめっき液23はポンプ14により、恒温ユニット15、フィルタ16、流量調整弁26及び弁 V_2 を経由して下部ヘッダ13に送られ、めっき槽11内を通過し、上部ヘッダ12及び弁 V_3 を経て再びめっき循環槽25に戻る。

【0032】上記のように、所定のタイミングでめっき槽11内のめっき液23の流れを逆転させることにより、被めっき基板19のめっき面に形成されるめっき膜の膜厚は更に均一となる。また、これにより被めっき基板19のめっき面の微細穴へのめっき液23の出入りが促進され、微細穴の壁面にも膜厚の均一なめっき膜が形成できる。

【0033】また、上記構成のめっき装置10において、めっき槽11内の圧力を所定のタイミングで上下させる。即ち、めっき槽11内のめっき液23の流れが正方向に流れる時、「開」となっているめっき槽11の出口側の弁 V_4 をあるタイミングで「閉」とし、同時に「閉」となっている弁 V_6 を「開」とする。弁 V_6 のラインには流量調整弁27があり、該流量調整弁27は弁 V_4 のラインよりも少流量に調整されている。このため弁 V_6 のラインに切り換えると同時にラインの圧力が上昇する。

【0034】このように、弁 V_4 と V_6 を所定のタイミングで開閉することにより、めっき液23が正方向に流れている場合、めっき槽11内の圧力を上下させることができる。また、弁 V_5 のラインには流量調整弁28があり、該流量調整弁28は弁 V_3 のラインよりも少流量に調整されているから、弁 V_3 と弁 V_5 を所定のタイミングで開閉することにより、めっき液23が逆方向に流れている場合、めっき槽11内の圧力を上下させることができる。このようにめっき槽11内の圧力を上下させることにより、被めっき基板19のめっき面の微細穴内の気泡が容易に抜けると共に、該微細穴へのめっき液の入り込みが良く、めっき面全面に均一な膜厚のめっき膜が形成できる。

【0035】めっき液23として CuSO_4 液を用いた場合、めっき液23が乾くと硫酸銅の結晶の生成が著しく、これがパーティクルとして悪影響を及ぼすという問題がある。そこで、上記構成のめっき装置に、めっき工程後にめっき槽11からめっき液23を排出し、代わりにめっき槽11及び上下ヘッダ12、13の内部に水 wash 水を導入する手段を設け、めっき工程後、これらめっき槽11及び上下ヘッダ12、13内に水 wash 水を流し込んで水洗するようにする。これにより、パーティクルの生成は防止され、パーティクルによる悪影響を除去できる。

【0036】更に、水 wash 水を排出後、 N_2 ガスやドライ空気等の水切りのための気体をめっき槽11に導入し、被めっき基板19及びめっき槽11内を乾燥させること

で、装置内の汚染が軽減され、且つ被めっき基板19の表面が乾燥されるため、パーティクルが付着しにくくなる。

【0037】なお、図1は本発明のめっき装置の一構成例であり、本発明はこれに限定されるものではなく、要は被めっき基板面を垂直又は傾斜させる構成であればよい。また、めっき液を前記被めっき基板表面に対して平行に流すことができ、且つめっき液流路の幅及び長さが被めっき基板の径より大きい構造とすればよい。

【0038】以下、本発明に係るめっき装置の具体的構成例を説明する。図4はめっき槽の具体的構成例を示す図で、図4(a)はめっき槽11の側断面図、図4

(b)は図4(a)のB部分の拡大図である。また、図5は側板18の具体的構成例を示す平面図である。めっき槽11の内部は省略するが、図1と略同様の構成であり、断面コ字状のめっき槽本体17と平板状の側板18からなる。該側板18の上面には後に詳述する被めっき基板装着機構により、被めっき基板19を装着できるようになっている。また、めっき槽本体17の側板18と対向する開口部にはブラケット32を介在させて環状のパッキン20がリング(座金)29及びビス31で固定されており、更に該リング29の上面には等間隔で電極(接点板)30がビス31でリング29と共締で固定されている。

【0039】側板18に被めっき基板19を装着し、ヒンジ機構(後に詳述)を介して該側板18をめっき槽本体17の開口部に当接させると、環状のパッキン20の内縁部は被めっき基板19の周縁面上に密着し、図1に示すような、遮蔽板22、被めっき基板19及びパッキン20で囲まれためっき液23が流れる空間が形成される。それと同時に陰極となる電極30の先端が被めっき基板19の導電部に当接する。なお、この状態で側板18に装着された被めっき基板19の面は垂直又は傾斜できるようになっている。傾斜の角度は $0 \sim 30^\circ$ の範囲で上を向くようにするのが好ましいが、これに限定されるものではない。また、側板18の所定の位置には被めっき基板19が側板18に装着されたか否かを検出するセンサ33が設けられている。

【0040】また、環状のパッキン20は図4(b)の点線で示すように、内周縁部がめっき槽本体17の外側に漏斗状に突出(外側に傾斜して突出)しており、被めっき基板19の周縁面がこの内周縁部先端に当接し押され実線の位置に変形するように構成されている。ここで、めっき槽11内の内圧をP、ブラケット32の内径を D_1 、パッキン20の内径を D_2 とすると、 $P \times (D_1^2 - D_2^2) \pi / 4$ の力が発生し、該力でパッキン20を被めっき基板19側に押し付け、パッキン20のシール性が向上する。従って、めっき槽11の内圧を外圧(大気圧)より高くすることにより、パッキン20に図4

(b)の矢印Fに示すような上記力が加わり、パッキン

20の内周縁部先端が被めっき基板19の周縁面に強く押し付けられ、シール性が向上する。

【0041】また、図4及び図5に示すようにパッキン20の外側（めっき液が接しない側）に電極30があり、電極30は被めっき基板19の周縁面のパッキン20の内周縁部先端が当接するシール箇所より更に外側で被めっき基板19と接触しているから、めっき液と接触することがなく、めっきが施されることがない。従って、電極30からパーティクルの発生を防ぐことができる。また、同時に電極30は安定した状態の導通を維持できる。

【0042】図6及び図7はめっき槽11の槽開閉機構の構成を示す図である。図において、35は槽開閉部材であり、該槽開閉部材35に側板18がブラケット42及びピン43を介して支えられている。また、槽開閉部材35の下端はヒンジ機構37でめっき槽11のめっき槽本体17の下端に支えられている。38は槽開閉用シリンダで、該槽開閉用シリンダ38のピストン38aの先端が前記ピン43に支えられて、該槽開閉用シリンダ38を作動させ、ピストン38aを前進後退させることにより、槽開閉部材35はヒンジ機構37を中心に回転し、該槽開閉部材35に支えられた側板18が回転し、めっき槽11を開閉する。

【0043】めっき槽11のめっき槽本体17の上部には支持部材41を介してロック用シリンダ34が設けられ、該ロック用シリンダ34のピストン34aにはロック部材36が連結されている。槽開閉用シリンダ38を作動させピストン38aを前進させると、槽開閉部材35及び側板18は回転し、側板18がめっき槽本体17に当接する位置に達したら、ロック用シリンダ34を作動させることにより、図7に示すように、ロック部材36が突出し、槽開閉部材35の上端部に設けられたロック用突起部39に係合し、槽開閉部材35及び側板18はロックされる。

【0044】40は側板18と槽開閉部材35の間の遊びを調整するための調整用のヒンジ機構であり、該ヒンジ機構40を介して側板18と槽開閉部材35は所定寸法の遊びを介して互いに結合されており、この遊びの間隔はナット40aで調整され、側板18に装着された被めっき基板19がパッキン20に当接してからロックされるまでの間隔を調整している。

【0045】上記槽開閉部材35を開いた状態、即ち側板18を図6のCの位置で、側板18に被めっき基板19を装着する。図8及び図9は被めっき基板装着機構の構成を示す図である。図示するように、被めっき基板装着機構は側板18に固定された爪駆動用シリンダ44を具備し、該爪駆動用シリンダ44のピストン44aの先端には先端が側板18の上部表面に突出する被めっき基板保持用爪45が固定されている。また、側板18の下部には被めっき基板保持用爪46がその先端が該側板1

8の下部表面にバネ等（図示せず）を介して突出自在に設けられている。

【0046】また、爪駆動用シリンダ44の下端に固定したロッド50にはバネ51を介して部材49が摺動自在に設けられ、該部材49の一端にはローラー47が回転自在に設けられ、他端には連結部材52を介して前記被めっき基板保持用爪46を押圧する爪押圧部材48が連結されている。なお、爪押圧部材48はピン53を支点に回転自在に支えられている。また、54は前記ローラー47が当接する当接部材である。

【0047】上記構成の被めっき基板装着機構において、図6の槽開閉用シリンダ38を動作させて、側板18を図9に示すように開くと、ローラー47が当接部材54に当接し、部材49を押し上げる。これにより、爪押圧部材48の端部が連結部材52を介して引っ張られピン53を中心に時計方向に回転する。これにより該爪押圧部材48で、被めっき基板保持用爪46を押す。これにより、該被めっき基板保持用爪46が所定寸法だけ側板18の表面に突出する。また、爪駆動用シリンダ44を作動させることにより、被めっき基板保持用爪45が所定寸法上方に移動する。この状態で被めっき基板保持用爪46と被めっき基板保持用爪45の間隔は被めっき基板19の径より、所定量大きくなっている。

【0048】この状態で、図示しない、ロボットアーム先端に把持された被めっき基板19を被めっき基板保持用爪46と被めっき基板保持用爪45の間の側板18の上面に載置する。この被めっき基板19が載置されたことは、センサ33（図4参照）で検出する。爪駆動用シリンダ44を作動させ、被めっき基板保持用爪45を被めっき基板19の側縁に当接するまで移動させ、被めっき基板19を被めっき基板保持用爪46と被めっき基板保持用爪45で挟持する。これにより、被めっき基板19は側板18の上に装着される。

【0049】続いて、図6の槽開閉用シリンダ38を作動させピストン38aを伸ばすことにより、槽開閉部材35はヒンジ機構37を中心に反時計方向に回転し、それに連動して側板18も反時計方向に回転する。これによりローラー47は当接部材54から外れ、部材49及び連結部材52はバネ51に押されて所定寸法下降する。これにより、爪押圧部材48がピン53を中心に反時計方向に回転し、被めっき基板保持用爪46を開放する。これにより被めっき基板保持用爪46は後退するが、その先端は被めっき基板19の外縁部を支持できるだけ側板18の上面より突出し、被めっき基板19を支持する。

【0050】上記のように側板18がめっき槽本体17の開口部を閉じ、環状のパッキン20の内縁部が被めっき基板19の周縁面に密着し、遮蔽板22、被めっき基板19及びパッキン20で囲まれためっき液23が流れる空間が形成されると、図1のポンプ14を起動し、

めっき液23を該空間に流してめっきを行うのであるが、被めっき基板19が側板18に装着されていないと、このめっき液23を流す閉じられた空間が形成されないから、ポンプ14を起動するとめっき液23が外部に流出することになる。そこで、本実施形態例では、上記センサ33の出力により、被めっき基板19が装着されているか否を検出し、もし被めっき基板19が装着されていない時は、警報を発する等を行い、少なくともポンプ14に起動電源が投入されてもポンプ14を起動しないようにする。これにより、被めっき基板19が装着されていない状態でめっき槽11内にめっき液23が供給されてめっき槽11の外に流れるという心配はなく、安全となる。

【0051】図10は本発明のめっき装置のめっき槽の他の構成例を示す図である。同図において、図1と同一符号を付した部分は同一又は相当部分を示す。図示するように、本めっき槽11はめっき槽本体17に遮蔽板22を嵌合挿入した構成とし、めっき槽本体17の面と遮蔽板22の面を同一面で連続させ、且つ遮蔽板22の中央部に設けられた電場調整用の穴22aに陽極電極21を嵌合挿入し遮蔽板22の面と陽極電極21の面を同一面で連続させた構成としている。そして側板18、遮蔽板22及び陽極電極21と被めっき基板19の間にめっき液を流す空間56を形成するように構成している。なお、55は遮蔽板22の穴22aの内周面と陽極電極の外周面の間に介装されるリングである。

【0052】なお、図10に示す構成のめっき槽11において、図示は省略するがめっき槽本体17の上下部に設けるめっき液が通る多数の穴17a及び17bは図1及び図2と同一である。また、めっき槽11へめっき循環槽25からめっき液を供給するめっき液の流路構成も図1に示す構成と同じである。

【0053】上記のように、めっき槽本体17の面と遮蔽板22の面及び陽極電極21の面を同一面で連続した構成とすることにより、この面と被めっき基板19の間の空間を流れるめっき液の流れの乱れが抑制され、被めっき基板19の面により均一なめっき膜が形成できる。

【0054】また、本発明に係る基板のめっき方法及び装置でめっき処理を施す被めっき基板としては、半導体ウエハに限らず、めっき処理を施す必要のある種々の基板が考えられる。

【0055】

【発明の効果】以上説明したように、各請求項によれば下記のような優れた効果が得られる。

【0056】請求項1に記載の発明によれば、めっき槽内のめっき液の圧力を変動させ、且つ該めっき液の流れ方向を切換えつつ、めっきを行うので、被めっき基板のめっき面に形成された微細な穴や溝からの気泡の抜け及び微細な穴や溝へのめっき液の入り込みが良く、より膜厚の均一なめっき膜を形成することができる。

【0057】請求項2に記載の発明によれば、めっき液流路をめっき液が被めっき基板のめっき面に平行に流れるように形成することにより、被めっき基板のめっき面にその大きさに左右されることなく、膜厚の均一なめっき膜を形成することができる。

【0058】また、請求項3に記載の発明によれば、被めっき基板のめっき面が、鉛直面に対して傾いた姿勢で保持されるので、パーティクルがめっき面に付着することがない。

【0059】また、請求項4に記載の発明によれば、被めっき基板面を鉛直から30°の範囲で上を向くように傾斜させる手段を設け、被めっき基板をこの範囲で傾斜させた状態でめっきを行うので、被めっき基板のめっき面の微細穴の気泡が容易に抜け、微細穴の内部までめっき液が流れ込み、その内壁面にもめっき膜が形成できる。また、パーティクルの被めっき基板のめっき面への付着もない。

【0060】また、請求項5に記載の発明によれば、めっき槽本体の開口部を側板で閉じた状態で該側板に装着された被めっき基板の周縁面がパッキンに当接し、該めっき槽本体と該被めっき基板の間にめっき液を被めっき基板のめっき面に対して平行に流すめっき液流路を形成するので、被めっき基板のめっき槽本体の開口部に露出しためっき面のみ平行に流れるめっき液が接触し、該めっき面以外の他の部分にめっき液に接触してめっきが施される等の不都合がなく、且つめっき面のみに膜厚の均一なめっき膜を形成することが可能となる。

【0061】また、請求項6に記載の発明によれば、センサの出力から被めっき基板が装着されていないと判断したとき、めっき槽にめっき液を供給しないようにするので、被めっき基板が装着されていない状態でめっき液が供給されることによる事故、例えば、めっき槽本体と被めっき基板の間にめっき液を流す密閉空間が形成されない状態でめっき槽にめっき液を流すことがないから、めっき液が外部に流出する等の危険はなくなる。

【図面の簡単な説明】

【図1】本発明のめっき装置の構成例を示す図である。

【図2】本発明のめっき装置のめっき槽の正断面（図1のB-B断面）を示す図である。

【図3】図3（a）、（b）、（c）は本発明の概念を説明するための図である。

【図4】本発明のめっき装置のめっき槽の構成例を示す図で、図4（a）はめっき槽の側断面図、図4（b）は図4（a）のB部分の拡大図である。

【図5】本発明のめっき装置のめっき槽の側板の構成例を示す平面図である。

【図6】本発明のめっき装置のめっき槽の槽開閉機構の構成を示す図である。

【図7】本発明のめっき装置のめっき槽の槽開閉機構の構成を示す図である。

【図 8】本発明のめっき装置の被めっき基板装着機構の構成を示す図である。

【図 9】本発明のめっき装置の被めっき基板装着機構の構成を示す図である。

【図 1 0】本発明のめっき装置のめっき槽の他の構成例を示す図である。

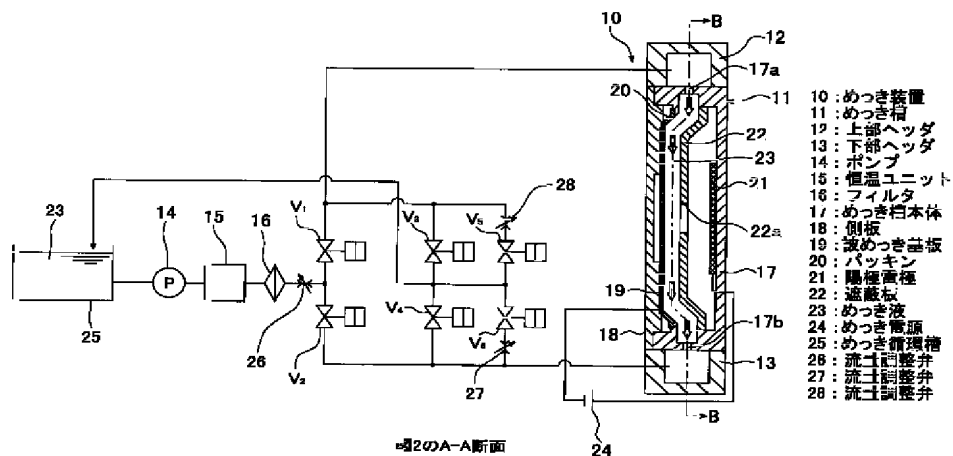
【図 1 1】従来のめっき装置の構成例を示す図である。

【図 1 2】従来のめっき装置の構成例を示す図である。

【符号の説明】

1	めっき治具	27	流量調整弁
2	被めっき基板	28	流量調整弁
3	めっき液	29	リング（座金）
4	気泡	30	電極（接点板）
10	めっき装置	31	ビス
11	めっき槽	32	ブラケット
12	上部ヘッド	33	センサ
13	下部ヘッド	34	ロック用シリンダ
14	ポンプ	35	槽開閉部材
15	恒温ユニット	36	ロック部材
16	フィルタ	37	ヒンジ機構
17	めっき槽本体	38	槽開閉用シリンダ
18	側板	39	ロック用突起部
19	被めっき基板	40	ヒンジ機構
20	パッキン	41	支持部材
21	陽極電極	42	ブラケット
22	遮蔽板	43	ピン
23	めっき液	44	爪駆動用シリンダ
24	めっき電源	45	被めっき基板保持用爪
25	めっき循環槽	46	被めっき基板保持用爪
26	流量調整弁	47	ローラー
		48	爪押圧部材
		49	部材
		50	ロッド
		51	バネ
		52	連結部材
		53	ピン
		54	当接部材
		55	オリング
		56	空間

【図 1】



本発明のめっき装置の構成例

【図2】

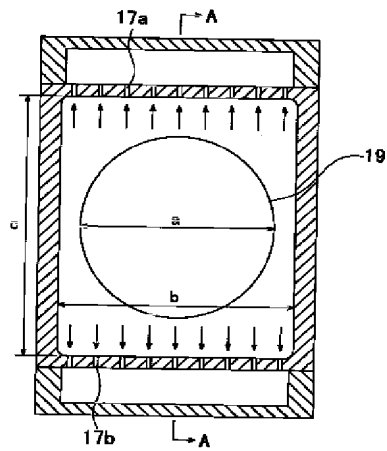
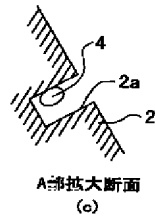
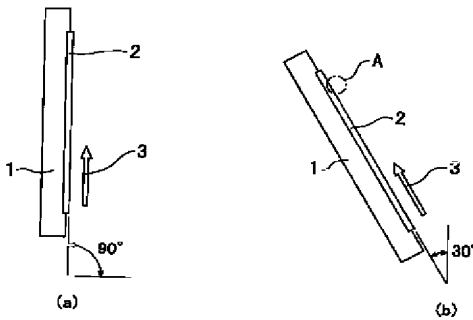


図1のB-B断面

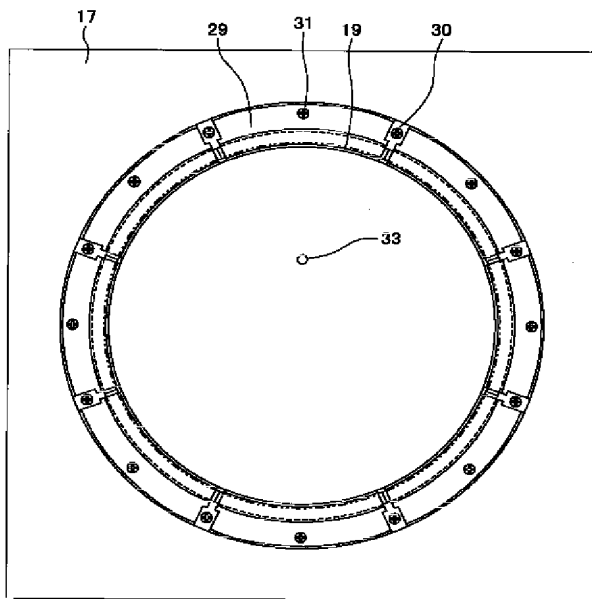
本発明のめっき装置のめっき槽

【図3】

A部拡大断面
(a)

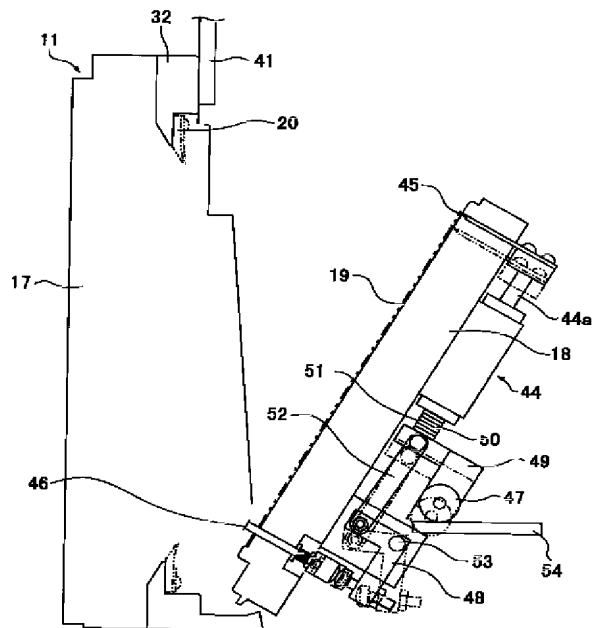
本発明の概念の説明

【図5】



本発明のめっき装置のめっき槽の側板の構成例

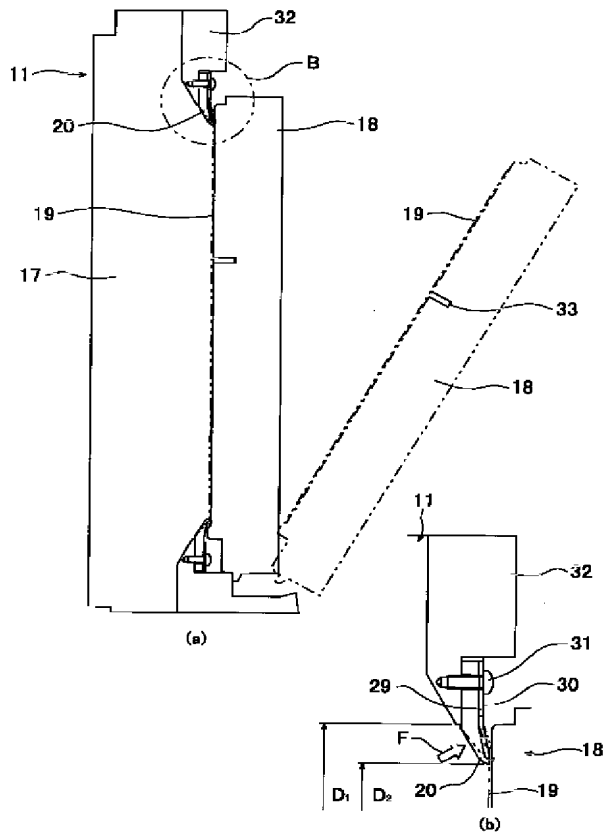
【図9】



- | | |
|---------------|---------------|
| 11:めっき槽 | 46:被めっき基板保持用爪 |
| 17:めっき槽本体 | 47:ローラー |
| 18:側板 | 48:爪押圧部材 |
| 19:被めっき基板 | 49:部材 |
| 20:パッキン | 50:ロッド |
| 32:ブラケット | 51:バネ |
| 41:支持部材 | 52:連結部材 |
| 44:爪駆動用シリンダ | 53:ピン |
| 45:被めっき基板保持用爪 | 54:当接部材 |

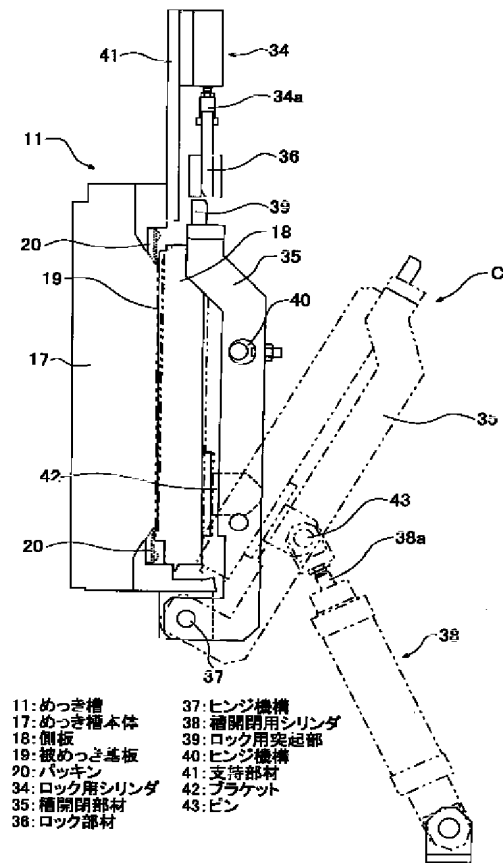
本発明のめっき装置の被めっき基板装置機構の構成

【図4】



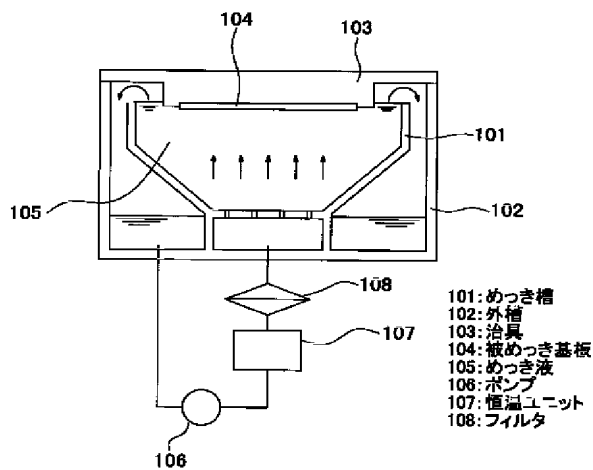
本発明のめっき装置のめっき槽の構成例

【図6】



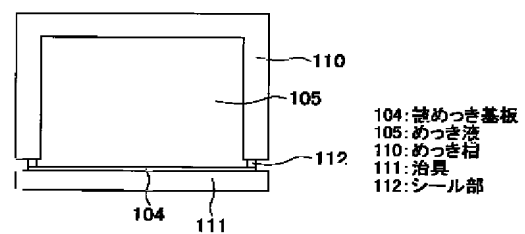
本発明のめっき装置のめっき槽の槽閉閉機構の構成

【図11】



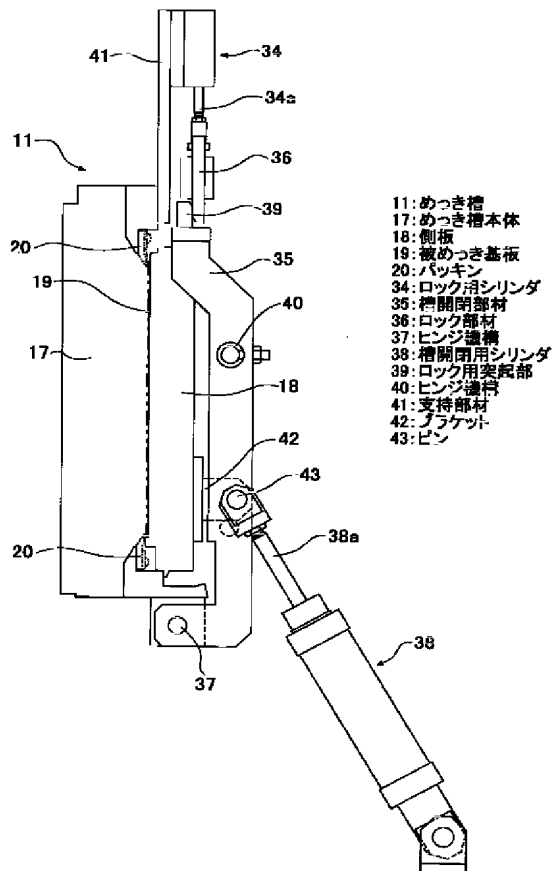
従来のめっき装置の構成例

【図12】



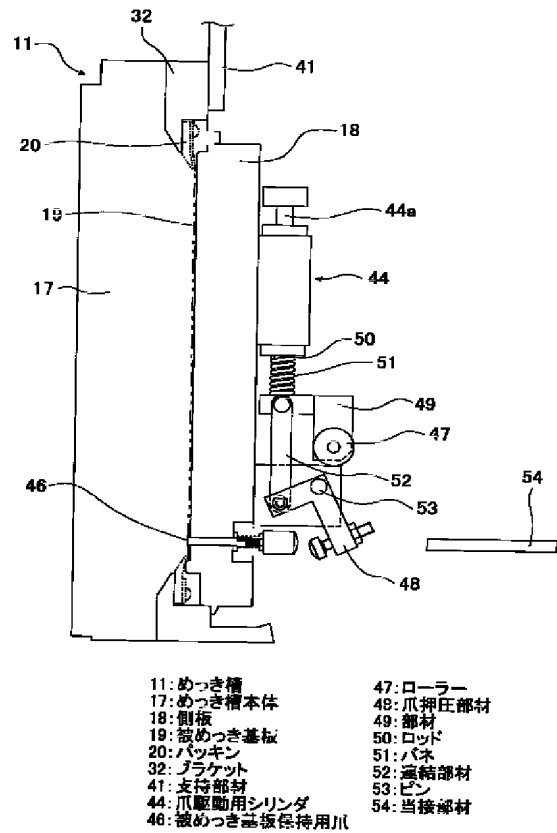
従来のめっき装置の構成例

【図7】



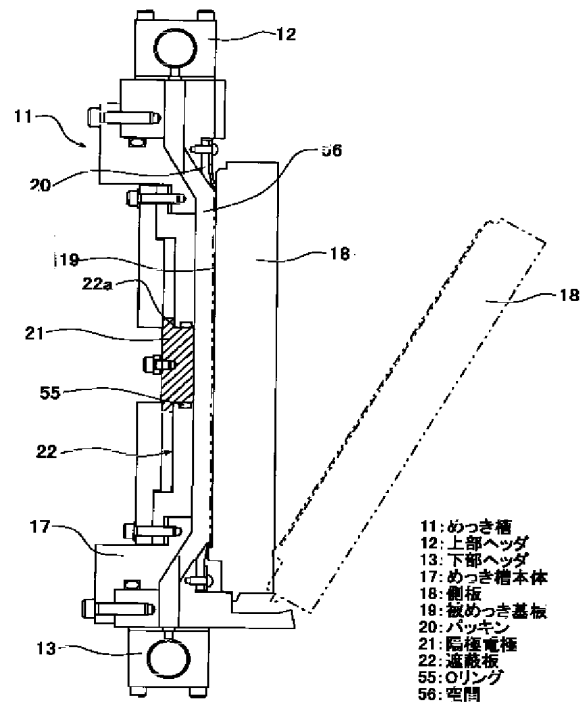
本発明のめっき装置のめっき槽の槽閉閉機構の構成

【図8】



本発明のめっき装置の被めっき基板装着機構の構成

【図10】



本発明のめっき装置のめっき槽の他の構成例

INFORMAL ENGLISH TRANSLATION OF
JAPANESE REFERENCE NO. 11-335895

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the plating method of a substrate and device which form a plating film in the plating side of substrates, such as a semiconductor wafer, to be plated.

[Translation done.]

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PRIOR ART

[Description of the Prior Art]There is a thing of composition of being conventionally shown in drawing 11 as this kind of a plating device. This plating device is composition which has arranged the outer tub 102 on the outside of the plating tub 101. In this plating device, the plating side of the substrate 104 with which the jig 103 was equipped to be plated is placed upside down, and it plates by pouring the plating liquid 105 toward the plating side of the substrate 104 to be plated from the plating tub 101 bottom. With the pump 106, the plating liquid 105 which overflowed the plating tub 101 passes along the homoiothermal unit 107 and the filter 108, and is sent to the plating tub 101, and it circulates through it.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, according to each claim, the following outstanding effects are acquired.

[0056]Since it plates fluctuating the pressure of the plating liquid in a plating tub, and switching the flow direction of this plating liquid according to the invention according to claim 1, An enter lump of the plating liquid to an omission, and the detailed hole and slot on the air bubbles from a detailed hole or a slot which were formed in the plating side of a substrate to be plated is good, and can form the uniform plating film of thickness more.

[0057]According to the invention according to claim 2, the uniform plating film of thickness can be formed, without being influenced by the size in the plating side of a substrate to be plated by forming so that plating liquid may flow through a plating liquid flow channel in parallel with the plating side of a substrate to be plated.

[0058]According to the invention according to claim 3, since the plating side of a substrate to be plated is held with the posture leaning to the vertical plane, particle does not adhere to a plating side.

[0059]Since it plates with the state where formed a means to make a substrates face to be plated incline so that it may turn to a top in 30 degrees from a vertical, and the substrate to be plated was made to incline in this range according to the invention according to claim 4, The air bubbles of the fine hole of the plating side of a substrate to be plated fall out easily, plating liquid flows in to the inside of a fine hole, and a plating film can be formed also in the internal surface. There is also no adhesion in the plating side of the substrate of particle to be plated.

[0060]According to the invention according to claim 5, the edge surface of the substrate with which this side plate was equipped where the opening of a plating tub main part is closed with a side plate to be plated contacts packing, Since the plating liquid flow channel which pours plating liquid in parallel to the plating side of a substrate to be plated is formed between this plating tub main part and this substrate to be plated, It becomes possible for the plating liquid which flows into parallel to contact only the plating side exposed to the opening of the plating tub main part of a substrate to be plated, to contact plating liquid at other portions other than this plating side, and for there to be no inconvenience — plating is performed — and to form the uniform plating film of thickness only in a plating side.

[0061]Since it is made not to supply plating liquid to a plating tub when it judges that it is not equipped with the substrate to be plated from the output of a sensor according to the invention according to claim 6, Since plating liquid is not poured to a plating tub in the state where a closed space which pours plating liquid is not formed between the accidents by plating liquid being supplied in the state where it is not equipped with the substrate to be plated, for example, a plating tub main part and a substrate to be plated, the danger of plating liquid flowing out outside disappears.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]In the plating device of the above-mentioned composition, since the plating side of the substrate 104 to be plated is downward, it is disadvantageous to put plating liquid into the detailed hole and slot of this plating side, and the more especially a bore diameter and a flute width become overly detailed, the air bubbles in a hole or a slot become difficult to escape, and, the more there is a problem that the plating liquid 105 does not enter easily. Since the flow of the plating liquid 105 is a vertical flow to the plating side of the substrate 104 to be plated, on the center and periphery of the substrate 104 to be plated, the thickness of a plating film differs and there is a problem that the thickness of a plating film does not become uniform. There was a problem of becoming so remarkable that this tendency becoming large if the path of a substrate to be plated becomes large.

[0004]In order that the air bubbles of the hole of the plating side of the substrate 104 to be plated may make it easy to escape, as shown in drawing 12, there is also a plating device which turned the plating side of the substrate 104 to be plated upward, but. In this method, there is a problem that the particle deposited on the wall surface of the plating tub 110, etc. adheres to the plating side of the substrate 104 to be plated easily. In drawing 12, the jig in which 111 equips with the substrate 104 to be plated, and 112 are seal parts.

[0005]It aims at providing the plating device which it was made in view of the above-mentioned point, the air bubbles of the fine hole of the plating side of a wafer escape easily, and this invention can form the plating film of uniform thickness in the plating side of a substrate to be plated, and particle etc. do not deposit easily in a plating tub.

[Translation done.]

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MEANS

[Means for Solving the Problem]In order to solve an aforementioned problem the invention according to claim 1, It plates accommodating a substrate to be plated into a sealed plating tub, being the plating method of a substrate which introduces plating liquid in this plating tub, and plates on a plating side of a substrate to be plated, and fluctuating a pressure of plating liquid, and switching a flow direction of this plating liquid.

[0007]By plating, fluctuating a pressure of plating liquid as mentioned above, and switching a flow direction of this plating liquid, There is no plating defect with a sufficient enter lump of plating liquid to an omission, and a detailed hole and a slot on the air bubbles from a detailed hole or a slot which were formed in a plating side of a substrate to be plated, and it becomes possible to form a uniform plating film of thickness more.

[0008]The invention according to claim 2 accommodates a substrate to be plated into a sealed plating tub, The channel is formed so that it may be a plating device of a substrate which introduces plating liquid in this plating tub, and plates on a plating side of a substrate to be plated and plating liquid may flow in parallel with a plating side of a substrate to be plated.

[0009]It becomes possible to form a uniform plating film of thickness, without being influenced by the size in a plating side of a substrate to be plated by forming so that plating liquid may flow through a plating liquid flow channel in parallel with a plating side of a substrate to be plated as mentioned above.

[0010]The invention according to claim 3 accommodates a substrate to be plated into a sealed plating tub, It is a plating device of a substrate which introduces plating liquid in this plating tub, and plates on a plating side of a substrate to be plated, and a plating side of a substrate to be plated is constituted so that it may be held with a posture leaning to a vertical plane.

[0011]Since a plating side of a substrate to be plated is held with a posture leaning to a vertical plane as mentioned above, particle does not adhere to a plating side.

[0012]In a plating device of the substrate according to claim 2, the invention according to claim 4 forms a means to make a plating side of a substrate to be plated incline so that it may turn to a top in 30 degrees from a vertical, and plates with the state where this substrate to be plated was made to incline in this range.

[0013]By forming a means to make a substrates face to be plated incline as mentioned above so that it may turn to a top in 30 degrees from a vertical, and plating with the state where a substrate to be plated was made to incline in this range, Air bubbles of a fine hole of a plating side of a substrate to be plated fall out easily, plating liquid flows in to an inside of a detailed hole or a slot, and a plating film can be formed also in the internal surface. There is also no adhesion in a plating side of a substrate of particle to be plated.

[0014]In a plating device of a substrate given in any 1 paragraph of claims 2 thru/or 4 the invention according to claim 5, A plating tub possesses a side plate which opens and closes an opening of a plating tub main part and this plating tub main part, and maintaining structure

holding a substrate is provided in this side plate, and. Form annular packing in an opens part of this plating tub main part, and an edge surface of a substrate with which this side plate was equipped where an opening of a plating tub main part is closed with a side plate to be plated contacts packing, It constituted so that a plating liquid flow channel which pours plating liquid in parallel to a plating side of a substrate to be plated might be formed between this plating tub main part and this substrate to be plated.

[0015]An edge surface of a substrate with which this side plate was equipped where an opening of a plating tub main part is closed with a side plate as mentioned above to be plated contacts packing, Since a plating liquid flow channel which pours plating liquid in parallel to a plating side of a substrate to be plated is formed between this plating tub main part and this substrate to be plated, It becomes possible for plating liquid which flows into parallel to contact only a plating side exposed to an opening of a plating tub main part of a substrate to be plated, for plating liquid to contact portions other than this plating side, and for there to be no inconvenience — plating is performed — and to form a uniform plating film of thickness only in a plating side.

[0016]In a plating device of a substrate given in any 1 paragraph of claims 2 thru/or 5 the invention according to claim 6, A sensor which detects wearing of a substrate to be plated was formed in a plating tub, and when it judged that it is not equipped with a substrate to be plated from an output of this sensor, a means kept from supplying plating liquid to a plating tub at least was formed.

[0017]Since it is made not to supply plating liquid to a plating tub when it judges that it is not equipped with a substrate to be plated from an output of a sensor as mentioned above, accidents, such as plating liquid leakage generated by supplying plating liquid in the state where it is not equipped with a substrate to be plated, can be prevented.

[0018]In a plating device given in any 1 paragraph of claims 2 thru/or 6, A shield and an anode electrode in which a plating tub main part was countered with a substrate to be plated, and a hole for electric field adjustment was formed in an approximately center part are arranged, and fitting insertion of this anode electrode was carried out in a hole for electric field adjustment of this shield, and it was constituted so that a field of this shield and a field of this anode electrode might continue in respect of being the same in abbreviation. Thereby, a flow of plating liquid which flows between a field of a shield, a field of an anode electrode, and a wafer surface has little disorder, and more uniform plating is attained.

[0019]In a plating device given in any 1 paragraph of claims 2 thru/or 6, plating liquid was poured in parallel to a plating side, and a means passed to an opposite direction to predetermined timing was formed. It enables this to form a uniform plating film of thickness.

[0020]In a plating device given in any 1 paragraph of claims 2 thru/or 6, a means to fluctuate a pressure in a plating tub to predetermined timing was formed. Thereby, an enter lump of an omission of air bubbles from a fine hole and plating liquid of a fine hole is good, and it becomes possible more to form a uniform plating film of thickness.

[0021]In a plating device given in any 1 paragraph of claims 2 thru/or 6, plating liquid was discharged behind as a plater, and water washing was passed instead and a means to rinse inside of a plating side and said plating tub was formed. Thereby, generation of particle is prevented and an adverse effect by particle can be removed.

[0022]A discharge rear stirrup of the above-mentioned plating liquid formed a means to pass a gas for a drainer after discharge of water washing in a plating tub. Since inside of a substrate to be plated and a plating tub can be dried, and contamination in a device is reduced by this and the surface of a substrate to be plated is dried, particle becomes difficult to adhere.

[0023]

[Embodiment of the Invention]the following and an embodiment of the invention — an example is explained based on a drawing. Drawing 3 is a figure for explaining the concept of this invention. As shown in drawing 3 (a), the plating side of the substrate 2 which plates the semiconductor

wafer etc. with which the plating jig 1 was equipped to be plated is perpendicularly installed in the sealed plating tub (not shown), and the plating liquid 3 is poured from a lower part in parallel to this plating side toward the upper part. Thus, there is no plating nonuniformity and a uniform plating film can be formed because the plating liquid 3 flows in parallel with the plating side of the substrate 2 to be plated within the sealed plating tub. And by changing into the state where the substrate 2 to be plated was stood in the substantially vertical direction, the problem that particle adheres to the plating side of the substrate 2 to be plated during plating is prevented.

[0024]Prevention of particle attachment can be attained also as a state which leaned the substrate 2 to be plated from the perpendicular direction as shown in drawing 3 (b). Although this effect shows the case where the plating side of the substrate 2 to be plated is upward, in drawing 3 (b), the same thing is natural, even when it leans so that the plating side of the substrate 2 to be plated may serve as facing down.

[0025]When making the substrate 2 to be plated incline from a vertical plane as shown in drawing 3 (b) and making it a plating side turn to a top, as shown in drawing 3 (c), it is easy to escape from the air bubbles 4 of the hole 2a of the substrate 2 to be plated, and they become. By therefore, the thing for which the plating side of the substrate 2 to be plated is leaned upward from a vertical plane as shown in drawing 3 (c). Particle does not adhere to the plating side of a substrate to be plated, but the plating film of uniform thickness can be further formed in the plating side of the substrate 2 to be plated by pouring the plating liquid 3 in parallel with the plating side of the substrate 2 to be plated, without being influenced by the size of the substrate 2 to be plated.

[0026]Since plating liquid is poured in parallel with the plating side of the substrate 2 to be plated in the sealed space as a feature of this plating tub, it becomes possible to adjust arbitrarily the pressure, the flow direction, and the degree of rate of flow of plating liquid. A plating film can be precisely formed in the slot and hole which were formed in the plating side of a detailed substrate to be plated by this.

[0027]Drawing 1 is a figure showing the example of composition of the plating device of this invention. Drawing 2 shows the right section (B-B section of drawing 1) of a plating tub. These plating devices 10 are the plating tub 11 and the composition of providing the upper header 12, the lower header 13, and the pump 14, the homoiothermal unit 15 and the filter 16 up and down. By the plating tub's 11 consisting of the plating tub main part 17 of a section U shape which has an opening, and the plate-like side plate 18, equipping this side plate 18 with the substrate 19 to be plated, sticking this side plate 18 to the opening portion mouth of the plating tub main part 17, and fixing. The packing 20 is stuck and fixed to the edge part of the substrate 19 to be plated. The anode electrode 21 plate-like in the plating tub main part 17 is formed. The substrate 19 to be plated and the anode electrode 21 are arranged in parallel. In drawing 1, the plating tub 11 shows the A-A section of drawing 2.

[0028]Between the anode electrode 21 and the substrate 19 to be plated, the shield 22 which consists of dielectric plates is arranged, the center section of this shield 22 is countered in the plating side of the substrate 19 to be plated, and the hole 22a is formed. This hole 22a is a hole for electric field adjustment which does so the operation which adjusts the electric field of the plating side of the substrate 19 to be plated. Between the substrate 19 to be plated and the shield 22, a parallel crevice is formed, and when the plating liquid 23 flows through this crevice, the flow of the plating liquid 23 flows in parallel to the plating side of the substrate 19 to be plated. The width b of the channel of the plating liquid 23 and length c are larger than the path a of the substrate 19 to be plated. Many holes 17a and holes 17b along which plating liquid passes are established in the vertical section of the plating tub main part 17. Between the anode electrode 21 and the substrate 19 to be plated, predetermined voltage is impressed from the plating power supply (DC power supply) 24.

[0029]when pouring the plating liquid 23 for Masakata in the plating tub 11 in the plating device

10 of the above-mentioned composition, while making valve V_1 and valve V_4 "open" — valve V_2 , valve V_3 , valve V_5 , and V_6 — "closed" is used. With the pump 14, the plating liquid 23 in the plating circulation tank 25 is sent to the upper header 12 via the homiothermal unit 15, the filter 16, the flow control valve 26, and valve V_1 , passes through the inside of the plating tub 11, and returns to the plating circulation tank 25 again through the lower header 13 and valve V_4 . Within the plating tub 11, it passes along the hole 17a of the upper part of the plating tub main part 17, and flows through the crevice between the substrate 19 to be plated and the shield 22, and also flows through the hole 17b of the lower part of the plating tub main part 17. Predetermined voltage is impressed between the anode electrode 21 and the substrate 19 to be plated from the plating power supply 24.

[0030]In the plating device of the above-mentioned composition, since the substrate 19 to be plated is being fixed to the side plate 18 of the plating tub 11, the substrate 19 to be plated will incline the plating tub 11 by vertical or making it incline. As an angle made to incline, although the range of 0-30 degrees is preferred, it is not limited to this. Therefore, it escapes from the air bubbles of the detailed hole of a plating side easily, and the adhesion of particle of them is also lost. If the plating liquid 23 flows through the crevice between the substrate 19 to be plated and the shield 22, The flow of the plating liquid 23 can form the uniform plating film of thickness in the plating side of the substrate 19 to be plated, without being influenced by the size of the substrate 19 to be plated since it becomes a parallel flow to the plating side of the substrate 19 to be plated as mentioned above. Since the width b of the channel of plating liquid and length c are formed more greatly than the path a of the substrate 19 to be plated, the flow of plating liquid also becomes uniform all over the substrate 19 to be plated, and can form the uniform plating film of thickness in the plating side of the substrate 19 to be plated.

[0031]In the plating device of the above-mentioned composition, the flow of the plating liquid 23 in the plating tub 11 is reversed to predetermined timing. namely, — while making valve V_2 and valve V_3 "open" — valve V_1 , valve V_4 , valve V_5 , and valve V_6 — "closed", With the pump 14, the plating liquid 23 in the plating circulation tank 25 is sent to the lower header 13 via the homiothermal unit 15, the filter 16, the flow control valve 26, and valve V_2 , passes through the inside of the plating tub 11, and returns to the plating circulation tank 25 again through the upper header 12 and valve V_3 .

[0032]As mentioned above, the thickness of the plating film formed in the plating side of the substrate 19 to be plated becomes still more uniform by reversing the flow of the plating liquid 23 in the plating tub 11 to predetermined timing. Receipts and payments of the plating liquid 23 to the fine hole of the plating side of the substrate 19 to be plated are promoted by this, and the uniform plating film of thickness can be formed also in the wall surface of a fine hole.

[0033]The pressure in the plating tub 11 is made to go up and down to predetermined timing in the plating device 10 of the above-mentioned composition. namely, valve V_4 of the outlet side of the plating tub 11 which serves as "open" when the flow of the plating liquid 23 in the plating tub 11 flows for Masakata — a certain timing — "considering it as closed" — simultaneous — "let valve V_6 used as closed" be "open." There is the flow control valve 27 in the line of valve V_6 , and this flow control valve 27 is adjusted to the small flow rather than the line of valve V_4 . For this reason, the pressure of a line rises at the same time it switches to the line of valve V_6 .

[0034]Thus, when the plating liquid 23 is flowing for Masakata by opening and closing valve V_4 and V_6 to predetermined timing, the pressure in the plating tub 11 can be made to go up and down. By opening and closing valve V_3 and valve V_5 to predetermined timing, since there is the

flow control valve 28 in the line of valve V_5 and this flow control valve 28 is adjusted to the small flow rather than the line of valve V_3 . When the plating liquid 23 is flowing into the opposite direction, the pressure in the plating tub 11 can be made to go up and down. Thus, by making the pressure in the plating tub 11 go up and down, the air bubbles in the fine hole of the plating side of the substrate 19 to be plated fall out easily, and an enter lump of the plating liquid to this fine hole is good, and the plating film of uniform thickness can be formed all over a plating side.

[0035]When CuSO_4 liquid is used as the plating liquid 23, there is a problem that generation of the crystal of copper sulfate is remarkable when the plating liquid 23 gets dry, and this has an adverse effect as particle. Then, the plating liquid 23 is behind discharged from the plating tub 11 to the plating device of the above-mentioned composition as a plater, A means to introduce water washing into the inside of the plating tub 11 and the up-and-down headers 12 and 13 instead is formed, water washing is slushed as a plater in these plating tub 11 and the up-and-down header 12 and 13, and the back rinses it. Thereby, generation of particle is prevented and the adverse effect by particle can be removed.

[0036]By what the gas for the drainer of N_2 gas, dry air, etc. is introduced into the plating tub 11 after discharging water washing, and the inside of the substrate 19 to be plated and the plating tub 11 is dried for. Since the contamination in a device is reduced and the surface of the substrate 19 to be plated is dried, particle becomes difficult to adhere.

[0037]Drawing 1 is an example of 1 composition of the plating device of this invention, and this invention is not limited to this and, in short, should just be composition which is vertical or is made to incline about a substrates face to be plated. To said substrate face to be plated, it can pass in parallel and the width and length of a plating liquid flow channel should just make plating liquid a larger structure than the path of a substrate to be plated.

[0038]Hereafter, the example of concrete composition of the plating device concerning this invention is explained. Drawing 4 is a figure showing the example of concrete composition of a plating tub, drawing 4 (a) is a sectional side elevation of the plating tub 11, and drawing 4 (b) is an enlarged drawing of B portion of drawing 4 (a). Drawing 5 is a top view showing the example of concrete composition of the side plate 18. Although the inside of the plating tub 11 is omitted, it is the composition of the approximately said appearance as drawing 1, and consists of the plating tub main part 17 of a section U shape, and the plate-like side plate 18. According to the plating board mounting mechanism explained in full detail behind, the upper surface of this side plate 18 can be equipped now with the substrate 19 to be plated. The bracket 32 is made placed between the side plate 18 of the plating tub main part 17, and the opening which counters, the annular packing 20 is being fixed on the ring (washer) 29 and the screw 31, and the electrode (contact plate) 30 is being further fixed to the upper surface of this ring 29 on the screw 31 at equal intervals at the ring 29 and ****.

[0039]If the side plate 18 is equipped with the substrate 19 to be plated and this side plate 18 is made to contact the opening of the plating tub main part 17 via a hinge mechanism (it explains in full detail behind), The common-law marriage part of the annular packing 20 is stuck on the edge surface of the substrate 19 to be plated, and the space through which the plating liquid 23 surrounded by the shield 22, the substrate 19 to be plated, and the packing 20 as shown in drawing 1 flows is formed. The tip of the electrode 30 which turns into the negative pole simultaneously with it contacts the current carrying part of the substrate 19 to be plated. The field of the substrate 19 with which the side plate 18 was equipped in this state to be plated can be vertical, or can incline now. Although it is preferred to make it turn to a top in 0-30 degrees as for the angle of an inclination, it is not limited to this. The sensor 33 which detects whether the side plate 18 was equipped with the substrate 19 to be plated is formed in the position of the side plate 18.

[0040]As the dotted line of drawing 4 (b) shows, the inner periphery edge projected on the

outside of the plating tub main part 17 in the shape of a funnel (it inclines and projects outside), and is using annular packing 20 as it, and it is constituted so that the edge surface of the substrate 19 to be plated may be pushed in contact with this inner periphery edge tip and it may change into the position of a solid line. If the inside diameter of D_1 and the packing 20 is made into D_2 for the inside diameter of P and the bracket 32, here the internal pressure in the plating tub 11, The power of $P \times (D_1^2 - D_2^2) \pi / 4$ occurs, the packing 20 is pushed against the substrate [to be plated] 19 side by this power, and the sealing nature of the packing 20 improves.

Therefore, by making internal pressure of the plating tub 11 higher than outer pressure (atmospheric pressure), the above-mentioned power as shown in the packing 20 at the arrow F of drawing 4 (b) is added, the inner periphery edge tip of the packing 20 is strongly forced to the edge surface of the substrate 19 to be plated, and sealing nature improves.

[0041]As shown in drawing 4 and drawing 5, the outside (side which plating liquid does not touch) of the packing 20 has the electrode 30, Since the electrode 30 touches the substrate 19 to be plated outside further from the seal part where the inner periphery edge tip of the packing 20 of the edge surface of the substrate 19 to be plated contacts, plating liquid is not contacted and plating is not performed. Therefore, generating of particle can be protected from the electrode 30. The electrode 30 can maintain simultaneously the flow in the state where it was stabilized.

[0042]Drawing 6 and drawing 7 are the figures showing the composition of the tub opening-and-closing mechanism of the plating tub 11. In the figure, 35 is a tub opening and closing member, and the side plate 18 is ****(ed) by this tub opening and closing member 35 via the bracket 42 and the pin 43. The lower end of the tub opening and closing member 35 is ****(ed) by the lower end of the plating tub main part 17 of the plating tub 11 by the hinge mechanism 37. By 38 being a cylinder for tub opening and closing, and the tip of the piston 38a of this cylinder 38 for tub opening and closing being ****(ed) by said pin 43, operating this cylinder 38 for tub opening and closing, and carrying out the moved back of the piston 38a, It rotates focusing on the hinge mechanism 37, the side plate 18 ****(ed) by this tub opening and closing member 35 rotates, and the tub opening and closing member 35 opens and closes the plating tub 11.

[0043]The cylinder 34 for a lock is formed in the upper part of the plating tub main part 17 of the plating tub 11 via the support member 41, and the lock member 36 is connected with the piston 34a of this cylinder 34 for a lock. By the tub opening and closing member 35 and the side plate 18 rotating, and operating the cylinder 34 for a lock, if the position to which the side plate 18 contacts the plating tub main part 17 is reached if the cylinder 38 for tub opening and closing is operated and the piston 38a is advanced, As shown in drawing 7, the lock member 36 projects, it engages with the height 39 for a lock provided in the upper bed part of the tub opening and closing member 35, and the tub opening and closing member 35 and the side plate 18 are locked.

[0044]40 is a hinge mechanism for the adjustment for adjusting play between the side plate 18 and the tub opening and closing member 35, The interval after the substrate 19 with which the side plate 18 and the tub opening and closing member 35 of each other were combined via play of a prescribed dimension, the interval of this play was adjusted with the nut 40a, and the side plate 18 was equipped via this hinge mechanism 40 to be plated contacts the packing 20 until it is locked is adjusted.

[0045]The side plate 18 is equipped with the substrate 19 to be plated for the state 18 which opened the above-mentioned tub opening and closing member 35, i.e., a side plate, in the position of C of drawing 6. Drawing 8 and drawing 9 are the figures showing the composition of a plating board mounting mechanism. A plating board mounting mechanism possesses the cylinder 44 for a nail drive fixed to the side plate 18, and the nail 45 for plating board maintenance with which a tip projects in the upper surface of the side plate 18 is being fixed at the tip of the piston 44a of this cylinder 44 for a nail drive so that it may illustrate. The tip is established in the lower surface of this side plate 18 via the spring (not shown) etc. in the nail 46 for plating board

maintenance at the lower part of the side plate 18, enabling free projection.

[0046]The member 49 is formed in the rod 50 fixed to the lower end of the cylinder 44 for a nail drive via the spring 51, enabling free sliding. It is provided in one end of this member 49, enabling free rotation of the roller 47, and the nail pressing member 48 which presses said nail 46 for plating board maintenance via the connecting member 52 is connected with the other end. The nail pressing member 48 is ****(ed) by the fulcrum in the pin 53, enabling free rotation. 54 is a contact member which said roller 47 contacts.

[0047]In the plating board mounting mechanism of the above-mentioned composition, the cylinder 38 for tub opening and closing of drawing 6 is operated, and if the side plate 18 is opened as shown in drawing 9, the roller 47 will contact the contact member 54 and will push up the member 49. Thereby, the end of the nail pressing member 48 is pulled via the connecting member 52, and it rotates clockwise focusing on the pin 53. By this nail pressing member 48, this pushes the nail 46 for plating board maintenance. Thereby, this nail 46 for plating board maintenance projects on the surface of the side plate 18 only a prescribed dimension. The nail 45 for plating board maintenance moves to the prescribed dimension upper part by operating the cylinder 44 for a nail drive. this state — the interval of the nail 46 for plating board maintenance, and the nail 45 for plating board maintenance — the path of the substrate 19 to be plated — the specified quantity — it is large.

[0048]In this state, the substrate 19 which is not illustrated and which was grasped at the tip of a robot arm to be plated is laid in the upper surface of the side plate 18 between the nail 46 for plating board maintenance, and the nail 45 for plating board maintenance. That this substrate 19 to be plated was laid detects by the sensor 33 (refer to drawing 4). The cylinder 44 for a nail drive is operated, the nail 45 for plating board maintenance is moved until it contacts the side edge of the substrate 19 to be plated, and the substrate 19 to be plated is pinched by the nail 46 for plating board maintenance, and the nail 45 for plating board maintenance. Thereby, it is equipped with the substrate 19 to be plated on the side plate 18.

[0049]Then, by operating the cylinder 38 for tub opening and closing of drawing 6, and lengthening the piston 38a, it rotates counterclockwise focusing on the hinge mechanism 37, and the tub opening and closing member 35 is interlocked with it, and the side plate 18 also rotates it counterclockwise. Thereby, the roller 47 separates from the contact member 54, and the member 49 and the connecting member 52 are pushed on the spring 51, and it carries out prescribed dimension descent. Thereby, the nail pressing member 48 rotates counterclockwise focusing on the pin 53, and opens the nail 46 for plating board maintenance. Although the nail 46 for plating board maintenance retreats by this, the tip is projected from the upper surface of the side plate 18 as it can support the outer edge section of the substrate 19 to be plated, and supports the substrate 19 to be plated.

[0050]The side plate 18 closes the opening of the plating tub main part 17 as mentioned above, and the common-law marriage part of the annular packing 20 sticks to the edge surface part of the substrate 19 to be plated, if the space through which the plating liquid 23 surrounded by the shield 22, the substrate 19 to be plated, and the packing 20 flows is formed, will start the pump 14 of drawing 1, and will plate by pouring the plating liquid 23 to this space, but. Since the closed space which pours this plating liquid 23 is not formed unless the side plate 18 is equipped with the substrate 19 to be plated, when the pump 14 is started, the plating liquid 23 will flow out outside. Then, it performs emitting an alarm etc., and even if a starting power supply is supplied to the pump 14 at least, it is made not to start the pump 14 in this example of an embodiment, when it is equipped with the substrate 19 to be plated with the output of the above-mentioned sensor 33, or no is detected and it is not equipped with the substrate 19 to be plated. The plating liquid 23 is supplied in the plating tub 11 in the state where it is not equipped with the substrate 19 to be plated, by this, there is no fear of flowing out of the plating tub 11, and it becomes safe.

[0051] Drawing 10 is a figure showing other examples of composition of the plating tub of the plating device of this invention. In the figure, the portion which attached drawing 1 and identical codes shows a same or considerable portion. This plating tub 11 makes the shield 22 the plating tub main part 17 with the composition which carried out fitting insertion so that it may illustrate. It has composition which carried out fitting insertion of the anode electrode 21, and made the field of the shield 22, and the field of the anode electrode 21 follow the hole 22a for electric field adjustment which made the field of the plating tub main part 17, and the field of the shield 22 continue in respect of the same, and was established in the center section of the shield 22 in respect of the same. And it constitutes so that the space 56 which pours plating liquid may be formed between the side plate 18, the shield 22, and the anode electrode 21 and the substrate 19 to be plated. 55 is an O ring infixed between the inner skin of the hole 22a of the shield 22, and the peripheral face of an anode electrode.

[0052] In the plating tub 11 of composition of being shown in drawing 10, the holes 17a and 17b of a large number along which the plating liquid provided in the vertical section of the grabby tub main part 17 which a graphic display omits passes are the same as that of drawing 1 and drawing 2. The passage constitution of the plating liquid which supplies plating liquid to the plating tub 11 from the plating circulation tank 25 is the same as the composition shown in drawing 1.

[0053] As mentioned above, by considering the field of the plating tub main part 17, the field of the shield 22, and the field of the anode electrode 21 as the composition which continued in respect of the same, disorder of the flow of the plating liquid which flows through the space between this field and the substrate 19 to be plated is controlled, and a uniform plating film can be formed according to the field of the substrate 19 to be plated.

[0054] As a substrate which performs plating processing with the plating method of a substrate and device concerning this invention to be plated, not only a semiconductor wafer but various substrates which need to perform plating processing can be considered.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a figure showing the example of composition of the plating device of this invention.

[Drawing 2]It is a figure showing the right section (B-B section of drawing 1) of the plating tub of the plating device of this invention.

[Drawing 3]Drawing 3 (a), (b), and (c) is a figure for explaining the concept of this invention.

[Drawing 4]It is a figure showing the example of composition of the plating tub of the plating device of this invention, and drawing 4 (a) is a sectional side elevation of a plating tub, and drawing 4 (b) is an enlarged drawing of B portion of drawing 4 (a).

[Drawing 5]It is a top view showing the example of composition of the side plate of the plating tub of the plating device of this invention.

[Drawing 6]It is a figure showing the composition of the tub opening-and-closing mechanism of the plating tub of the plating device of this invention.

[Drawing 7]It is a figure showing the composition of the tub opening-and-closing mechanism of the plating tub of the plating device of this invention.

[Drawing 8]It is a figure showing the composition of the plating board mounting mechanism of the plating device of this invention.

[Drawing 9]It is a figure showing the composition of the plating board mounting mechanism of the plating device of this invention.

[Drawing 10]It is a figure showing other examples of composition of the plating tub of the plating device of this invention.

[Drawing 11]It is a figure showing the example of composition of the conventional plating device.

[Drawing 12]It is a figure showing the example of composition of the conventional plating device.

[Description of Notations]

1 Plating jig

2 A substrate to be plated

3 Plating liquid

4 Air bubbles

10 Plating device

11 Plating tub

12 Upper header

13 Lower header

14 Pump

15 A homothermal unit

16 Filter

17 Plating tub main part
18 Side plate
19 A substrate to be plated
20 Packing
21 Anode electrode
22 Shield
23 Plating liquid
24 Plating power supply
25 Plating circulation tank
26 Flow control valve
27 Flow control valve
28 Flow control valve
29 Ring (washer)
30 Electrode (contact plate)
31 Screw
32 Bracket
33 Sensor
34 The cylinder for a lock
35 Tub opening and closing member
36 Lock member
37 Hinge mechanism
38 The cylinder for tub opening and closing
39 The height for a lock
40 Hinge mechanism
41 Support member
42 Bracket
43 Pin
44 The cylinder for a nail drive
45 The nail for plating board maintenance
46 The nail for plating board maintenance
47 Roller
48 Nail pressing member
49 Member
50 Rod
51 Spring
52 Connecting member
53 Pin
54 Contact member
55 O ring
56 Space

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention]This invention relates to the plating method of a substrate and device which form a plating film in the plating side of substrates, such as a semiconductor wafer, to be plated.

[0002]

[Description of the Prior Art]There is a thing of composition of being conventionally shown in drawing 11 as this kind of a plating device. This plating device is composition which has arranged the outer tub 102 on the outside of the plating tub 101. In this plating device, the plating side of the substrate 104 with which the jig 103 was equipped to be plated is placed upside down, and it plates by pouring the plating liquid 105 toward the plating side of the substrate 104 to be plated from the plating tub 101 bottom. With the pump 106, the plating liquid 105 which overflowed the plating tub 101 passes along the homiothermal unit 107 and the filter 108, and is sent to the plating tub 101, and it circulates through it.

[0003]

[Problem(s) to be Solved by the Invention]In the plating device of the above-mentioned composition, since the plating side of the substrate 104 to be plated is downward, it is disadvantageous to put plating liquid into the detailed hole and slot of this plating side, and the more especially a bore diameter and a flute width become overly detailed, the air bubbles in a hole or a slot become difficult to escape, and, the more there is a problem that the plating liquid 105 does not enter easily. Since the flow of the plating liquid 105 is a vertical flow to the plating side of the substrate 104 to be plated, on the center and periphery of the substrate 104 to be plated, the thickness of a plating film differs and there is a problem that the thickness of a plating film does not become uniform. There was a problem of becoming so remarkable that this tendency becoming large if the path of a substrate to be plated becomes large.

[0004]In order that the air bubbles of the hole of the plating side of the substrate 104 to be plated may make it easy to escape, as shown in drawing 12, there is also a plating device which turned the plating side of the substrate 104 to be plated upward, but. In this method, there is a problem that the particle deposited on the wall surface of the plating tub 110, etc. adheres to the plating side of the substrate 104 to be plated easily. In drawing 12, the jig in which 111 equips with the substrate 104 to be plated, and 112 are seal parts.

[0005]It aims at providing the plating device which it was made in view of the above-mentioned point, the air bubbles of the fine hole of the plating side of a wafer escape easily, and this invention can form the plating film of uniform thickness in the plating side of a substrate to be plated, and particle etc. do not deposit easily in a plating tub.

[0006]

[Means for Solving the Problem]In order to solve an aforementioned problem the invention

according to claim 1, It plates accommodating a substrate to be plated into a sealed plating tub, being the plating method of a substrate which introduces plating liquid in this plating tub, and plates on a plating side of a substrate to be plated, and fluctuating a pressure of plating liquid, and switching a flow direction of this plating liquid.

[0007]By plating, fluctuating a pressure of plating liquid as mentioned above, and switching a flow direction of this plating liquid, There is no plating defect with a sufficient enter lump of plating liquid to an omission, and a detailed hole and a slot on the air bubbles from a detailed hole or a slot which were formed in a plating side of a substrate to be plated, and it becomes possible to form a uniform plating film of thickness more.

[0008]The invention according to claim 2 accommodates a substrate to be plated into a sealed plating tub, The channel is formed so that it may be a plating device of a substrate which introduces plating liquid in this plating tub, and plates on a plating side of a substrate to be plated and plating liquid may flow in parallel with a plating side of a substrate to be plated.

[0009]It becomes possible to form a uniform plating film of thickness, without being influenced by the size in a plating side of a substrate to be plated by forming so that plating liquid may flow through a plating liquid flow channel in parallel with a plating side of a substrate to be plated as mentioned above.

[0010]The invention according to claim 3 accommodates a substrate to be plated into a sealed plating tub, It is a plating device of a substrate which introduces plating liquid in this plating tub, and plates on a plating side of a substrate to be plated, and a plating side of a substrate to be plated is constituted so that it may be held with a posture leaning to a vertical plane.

[0011]Since a plating side of a substrate to be plated is held with a posture leaning to a vertical plane as mentioned above, particle does not adhere to a plating side.

[0012]In a plating device of the substrate according to claim 2, the invention according to claim 4 forms a means to make a plating side of a substrate to be plated incline so that it may turn to a top in 30 degrees from a vertical, and plates with the state where this substrate to be plated was made to incline in this range.

[0013]By forming a means to make a substrates face to be plated incline as mentioned above so that it may turn to a top in 30 degrees from a vertical, and plating with the state where a substrate to be plated was made to incline in this range, Air bubbles of a fine hole of a plating side of a substrate to be plated fall out easily, plating liquid flows in to an inside of a detailed hole or a slot, and a plating film can be formed also in the internal surface. There is also no adhesion in a plating side of a substrate of particle to be plated.

[0014]In a plating device of a substrate given in any 1 paragraph of claims 2 thru/or 4 the invention according to claim 5, A plating tub possesses a side plate which opens and closes an opening of a plating tub main part and this plating tub main part, and maintaining structure holding a substrate is provided in this side plate, and. Form annular packing in an opens part of this plating tub main part, and an edge surface of a substrate with which this side plate was equipped where an opening of a plating tub main part is closed with a side plate to be plated contacts packing, It constituted so that a plating liquid flow channel which pours plating liquid in parallel to a plating side of a substrate to be plated might be formed between this plating tub main part and this substrate to be plated.

[0015]An edge surface of a substrate with which this side plate was equipped where an opening of a plating tub main part is closed with a side plate as mentioned above to be plated contacts packing, Since a plating liquid flow channel which pours plating liquid in parallel to a plating side of a substrate to be plated is formed between this plating tub main part and this substrate to be plated, It becomes possible for plating liquid which flows into parallel to contact only a plating side exposed to an opening of a plating tub main part of a substrate to be plated, for plating liquid to contact portions other than this plating side, and for there to be no inconvenience — plating is performed — and to form a uniform plating film of thickness only in a plating side.

[0016]In a plating device of a substrate given in any 1 paragraph of claims 2 thru/or 5 the invention according to claim 6, A sensor which detects wearing of a substrate to be plated was formed in a plating tub, and when it judged that it is not equipped with a substrate to be plated from an output of this sensor, a means kept from supplying plating liquid to a plating tub at least was formed.

[0017]Since it is made not to supply plating liquid to a plating tub when it judges that it is not equipped with a substrate to be plated from an output of a sensor as mentioned above, accidents, such as plating liquid leakage generated by supplying plating liquid in the state where it is not equipped with a substrate to be plated, can be prevented.

[0018]In a plating device given in any 1 paragraph of claims 2 thru/or 6, A shield and an anode electrode in which a plating tub main part was countered with a substrate to be plated, and a hole for electric field adjustment was formed in an approximately center part are arranged, and fitting insertion of this anode electrode was carried out in a hole for electric field adjustment of this shield, and it was constituted so that a field of this shield and a field of this anode electrode might continue in respect of being the same in abbreviation. Thereby, a flow of plating liquid which flows between a field of a shield, a field of an anode electrode, and a wafer surface has little disorder, and more uniform plating is attained.

[0019]In a plating device given in any 1 paragraph of claims 2 thru/or 6, plating liquid was poured in parallel to a plating side, and a means passed to an opposite direction to predetermined timing was formed. It enables this to form a uniform plating film of thickness.

[0020]In a plating device given in any 1 paragraph of claims 2 thru/or 6, a means to fluctuate a pressure in a plating tub to predetermined timing was formed. Thereby, an enter lump of an omission of air bubbles from a fine hole and plating liquid of a fine hole is good, and it becomes possible more to form a uniform plating film of thickness.

[0021]In a plating device given in any 1 paragraph of claims 2 thru/or 6, plating liquid was discharged behind as a plater, and water washing was passed instead and a means to rinse inside of a plating side and said plating tub was formed. Thereby, generation of particle is prevented and an adverse effect by particle can be removed.

[0022]A discharge rear stirrup of the above-mentioned plating liquid formed a means to pass a gas for a drainer after discharge of water washing in a plating tub. Since inside of a substrate to be plated and a plating tub can be dried, and contamination in a device is reduced by this and the surface of a substrate to be plated is dried, particle becomes difficult to adhere.

[0023]

[Embodiment of the Invention]the following and an embodiment of the invention — an example is explained based on a drawing. Drawing 3 is a figure for explaining the concept of this invention. As shown in drawing 3 (a), the plating side of the substrate 2 which plates the semiconductor wafer etc. with which the plating jig 1 was equipped to be plated is perpendicularly installed in the sealed plating tub (not shown), and the plating liquid 3 is poured from a lower part in parallel to this plating side toward the upper part. Thus, there is no plating nonuniformity and a uniform plating film can be formed because the plating liquid 3 flows in parallel with the plating side of the substrate 2 to be plated within the sealed plating tub. And by changing into the state where the substrate 2 to be plated was stood in the substantially vertical direction, the problem that particle adheres to the plating side of the substrate 2 to be plated during plating is prevented.

[0024]Prevention of particle attachment can be attained also as a state which leaned the substrate 2 to be plated from the perpendicular direction as shown in drawing 3 (b). Although this effect shows the case where the plating side of the substrate 2 to be plated is upward, in drawing 3 (b), the same thing is natural, even when it leans so that the plating side of the substrate 2 to be plated may serve as facing down.

[0025]When making the substrate 2 to be plated incline from a vertical plane as shown in drawing 3 (b) and making it a plating side turn to a top, as shown in drawing 3 (c), it is easy to

escape from the air bubbles 4 of the hole 2a of the substrate 2 to be plated, and they become. By therefore, the thing for which the plating side of the substrate 2 to be plated is leaned upward from a vertical plane as shown in drawing 3 (c). Particle does not adhere to the plating side of a substrate to be plated, but the plating film of uniform thickness can be further formed in the plating side of the substrate 2 to be plated by pouring the plating liquid 3 in parallel with the plating side of the substrate 2 to be plated, without being influenced by the size of the substrate 2 to be plated.

[0026] Since plating liquid is poured in parallel with the plating side of the substrate 2 to be plated in the sealed space as a feature of this plating tub, it becomes possible to adjust arbitrarily the pressure, the flow direction, and the degree of rate of flow of plating liquid. A plating film can be precisely formed in the slot and hole which were formed in the plating side of a detailed substrate to be plated by this.

[0027] Drawing 1 is a figure showing the example of composition of the plating device of this invention. Drawing 2 shows the right section (B-B section of drawing 1) of a plating tub. These plating devices 10 are the plating tub 11 and the composition of providing the upper header 12, the lower header 13, and the pump 14, the homoiothermal unit 15 and the filter 16 up and down. By the plating tub's 11 consisting of the plating tub main part 17 of a section U shape which has an opening, and the plate-like side plate 18, equipping this side plate 18 with the substrate 19 to be plated, sticking this side plate 18 to the opening portion mouth of the plating tub main part 17, and fixing, The packing 20 is stuck and fixed to the edge part of the substrate 19 to be plated. The anode electrode 21 plate-like in the plating tub main part 17 is formed. The substrate 19 to be plated and the anode electrode 21 are arranged in parallel. In drawing 1, the plating tub 11 shows the A-A section of drawing 2.

[0028] Between the anode electrode 21 and the substrate 19 to be plated, the shield 22 which consists of dielectric plates is arranged, the center section of this shield 22 is countered in the plating side of the substrate 19 to be plated, and the hole 22a is formed. This hole 22a is a hole for electric field adjustment which does so the operation which adjusts the electric field of the plating side of the substrate 19 to be plated. Between the substrate 19 to be plated and the shield 22, a parallel crevice is formed, and when the plating liquid 23 flows through this crevice, the flow of the plating liquid 23 flows in parallel to the plating side of the substrate 19 to be plated. The width b of the channel of the plating liquid 23 and length c are larger than the path a of the substrate 19 to be plated. Many holes 17a and holes 17b along which plating liquid passes are established in the vertical section of the plating tub main part 17. Between the anode electrode 21 and the substrate 19 to be plated, predetermined voltage is impressed from the plating power supply (DC power supply) 24.

[0029] when pouring the plating liquid 23 for Masakata in the plating tub 11 in the plating device 10 of the above-mentioned composition, while making valve V_1 and valve V_4 "open" — valve V_2 , valve V_3 , valve V_5 , and V_6 — "closed" is used. With the pump 14, the plating liquid 23 in the plating circulation tank 25 is sent to the upper header 12 via the homoiothermal unit 15, the filter 16, the flow control valve 26, and valve V_1 , passes through the inside of the plating tub 11, and returns to the plating circulation tank 25 again through the lower header 13 and valve V_4 . Within the plating tub 11, it passes along the hole 17a of the upper part of the plating tub main part 17, and flows through the crevice between the substrate 19 to be plated and the shield 22, and also flows through the hole 17b of the lower part of the plating tub main part 17. Predetermined voltage is impressed between the anode electrode 21 and the substrate 19 to be plated from the plating power supply 24.

[0030] In the plating device of the above-mentioned composition, since the substrate 19 to be plated is being fixed to the side plate 18 of the plating tub 11, the substrate 19 to be plated will incline the plating tub 11 by vertical or making it incline. As an angle made to incline, although

the range of 0-30 degrees is preferred, it is not limited to this. Therefore, it escapes from the air bubbles of the detailed hole of a plating side easily, and the adhesion of particle of them is also lost. If the plating liquid 23 flows through the crevice between the substrate 19 to be plated and the shield 22, The flow of the plating liquid 23 can form the uniform plating film of thickness in the plating side of the substrate 19 to be plated, without being influenced by the size of the substrate 19 to be plated since it becomes a parallel flow to the plating side of the substrate 19 to be plated as mentioned above. Since the width b of the channel of plating liquid and length c are formed more greatly than the path a of the substrate 19 to be plated, the flow of plating liquid also becomes uniform all over the substrate 19 to be plated, and can form the uniform plating film of thickness in the plating side of the substrate 19 to be plated.

[0031]In the plating device of the above-mentioned composition, the flow of the plating liquid 23 in the plating tub 11 is reversed to predetermined timing. namely, — while making valve V_2 and valve V_3 “open” — valve V_1 , valve V_4 , valve V_5 , and valve V_6 — “— by using closed”. With the pump 14, the plating liquid 23 in the plating circulation tank 25 is sent to the lower header 13 via the homoiothermal unit 15, the filter 16, the flow control valve 26, and valve V_2 , passes through the inside of the plating tub 11, and returns to the plating circulation tank 25 again through the upper header 12 and valve V_3 .

[0032]As mentioned above, the thickness of the plating film formed in the plating side of the substrate 19 to be plated becomes still more uniform by reversing the flow of the plating liquid 23 in the plating tub 11 to predetermined timing. Receipts and payments of the plating liquid 23 to the fine hole of the plating side of the substrate 19 to be plated are promoted by this, and the uniform plating film of thickness can be formed also in the wall surface of a fine hole.

[0033]The pressure in the plating tub 11 is made to go up and down to predetermined timing in the plating device 10 of the above-mentioned composition. namely, valve V_4 of the outlet side of the plating tub 11 which serves as “open” when the flow of the plating liquid 23 in the plating tub 11 flows for Masakata — a certain timing — “— considering it as closed” — simultaneous — “— let valve V_6 used as closed” be “open.” There is the flow control valve 27 in the line of valve V_6 , and this flow control valve 27 is adjusted to the small flow rather than the line of valve V_4 . For this reason, the pressure of a line rises at the same time it switches to the line of valve V_6 .

[0034]Thus, when the plating liquid 23 is flowing for Masakata by opening and closing valve V_4 and V_6 to predetermined timing, the pressure in the plating tub 11 can be made to go up and down. By opening and closing valve V_3 and valve V_5 to predetermined timing, since there is the flow control valve 28 in the line of valve V_5 and this flow control valve 28 is adjusted to the small flow rather than the line of valve V_3 . When the plating liquid 23 is flowing into the opposite direction, the pressure in the plating tub 11 can be made to go up and down. Thus, by making the pressure in the plating tub 11 go up and down, the air bubbles in the fine hole of the plating side of the substrate 19 to be plated fall out easily, and an enter lump of the plating liquid to this fine hole is good, and the plating film of uniform thickness can be formed all over a plating side.

[0035]When CuSO_4 liquid is used as the plating liquid 23, there is a problem that generation of the crystal of copper sulfate is remarkable when the plating liquid 23 gets dry, and this has an adverse effect as particle. Then, the plating liquid 23 is behind discharged from the plating tub 11 to the plating device of the above-mentioned composition as a plater. A means to introduce water washing into the inside of the plating tub 11 and the up-and-down headers 12 and 13 instead is formed, water washing is slushed as a plater in these plating tub 11 and the up-and-down header 12 and 13, and the back rinses it. Thereby, generation of particle is prevented and the adverse effect by particle can be removed.

[0036]By what the gas for the drainer of N_2 gas, dry air, etc. is introduced into the plating tub 11 after discharging water washing, and the inside of the substrate 19 to be plated and the plating tub 11 is dried for. Since the contamination in a device is reduced and the surface of the substrate 19 to be plated is dried, particle becomes difficult to adhere.

[0037]Drawing 1 is an example of 1 composition of the plating device of this invention, and this invention is not limited to this and, in short, should just be composition which is vertical or is made to incline about a substrates face to be plated. To said substrate face to be plated, it can pass in parallel and the width and length of a plating liquid flow channel should just make plating liquid a larger structure than the path of a substrate to be plated.

[0038]Hereafter, the example of concrete composition of the plating device concerning this invention is explained. Drawing 4 is a figure showing the example of concrete composition of a plating tub, drawing 4 (a) is a sectional side elevation of the plating tub 11, and drawing 4 (b) is an enlarged drawing of B portion of drawing 4 (a). Drawing 5 is a top view showing the example of concrete composition of the side plate 18. Although the inside of the plating tub 11 is omitted, it is the composition of the approximately said appearance as drawing 1, and consists of the plating tub main part 17 of a section U shape, and the plate-like side plate 18. According to the plating board mounting mechanism explained in full detail behind, the upper surface of this side plate 18 can be equipped now with the substrate 19 to be plated. The bracket 32 is made placed between the side plate 18 of the plating tub main part 17, and the opening which counters, the annular packing 20 is being fixed on the ring (washer) 29 and the screw 31, and the electrode (contact plate) 30 is being further fixed to the upper surface of this ring 29 on the screw 31 at equal intervals at the ring 29 and ****.

[0039]If the side plate 18 is equipped with the substrate 19 to be plated and this side plate 18 is made to contact the opening of the plating tub main part 17 via a hinge mechanism (it explains in full detail behind), The common-law marriage part of the annular packing 20 is stuck on the edge surface of the substrate 19 to be plated, and the space through which the plating liquid 23 surrounded by the shield 22, the substrate 19 to be plated, and the packing 20 as shown in drawing 1 flows is formed. The tip of the electrode 30 which turns into the negative pole simultaneously with it contacts the current carrying part of the substrate 19 to be plated. The field of the substrate 19 with which the side plate 18 was equipped in this state to be plated can be vertical, or can incline now. Although it is preferred to make it turn to a top in 0-30 degrees as for the angle of an inclination, it is not limited to this. The sensor 33 which detects whether the side plate 18 was equipped with the substrate 19 to be plated is formed in the position of the side plate 18.

[0040]As the dotted line of drawing 4 (b) shows, the inner periphery edge projected on the outside of the plating tub main part 17 in the shape of a funnel (it inclines and projects outside), and is using annular packing 20 as it, and it is constituted so that the edge surface of the substrate 19 to be plated may be pushed in contact with this inner periphery edge tip and it may change into the position of a solid line. If the inside diameter of D_1 and the packing 20 is made into D_2 for the inside diameter of P and the bracket 32, here the internal pressure in the plating tub 11, The power of $P \times (D_1^2 - D_2^2) \pi / 4$ occurs, the packing 20 is pushed against the substrate [to be plated] 19 side by this power, and the sealing nature of the packing 20 improves. Therefore, by making internal pressure of the plating tub 11 higher than outer pressure (atmospheric pressure), the above-mentioned power as shown in the packing 20 at the arrow F of drawing 4 (b) is added, the inner periphery edge tip of the packing 20 is strongly forced to the edge surface of the substrate 19 to be plated, and sealing nature improves.

[0041]As shown in drawing 4 and drawing 5, the outside (side which plating liquid does not touch) of the packing 20 has the electrode 30, Since the electrode 30 touches the substrate 19 to

be plated outside further from the seal part where the inner periphery edge tip of the packing 20 of the edge surface of the substrate 19 to be plated contacts, plating liquid is not contacted and plating is not performed. Therefore, generating of particle can be protected from the electrode 30. The electrode 30 can maintain simultaneously the flow in the state where it was stabilized.

[0042] Drawing 6 and drawing 7 are the figures showing the composition of the tub opening-and-closing mechanism of the plating tub 11. In the figure, 35 is a tub opening and closing member, and the side plate 18 is ****(ed) by this tub opening and closing member 35 via the bracket 42 and the pin 43. The lower end of the tub opening and closing member 35 is ****(ed) by the lower end of the plating tub main part 17 of the plating tub 11 by the hinge mechanism 37. By 38 being a cylinder for tub opening and closing, and the tip of the piston 38a of this cylinder 38 for tub opening and closing being ****(ed) by said pin 43, operating this cylinder 38 for tub opening and closing, and carrying out the moved back of the piston 38a, It rotates focusing on the hinge mechanism 37, the side plate 18 ****(ed) by this tub opening and closing member 35 rotates, and the tub opening and closing member 35 opens and closes the plating tub 11.

[0043] The cylinder 34 for a lock is formed in the upper part of the plating tub main part 17 of the plating tub 11 via the support member 41, and the lock member 36 is connected with the piston 34a of this cylinder 34 for a lock. By the tub opening and closing member 35 and the side plate 18 rotating, and operating the cylinder 34 for a lock, if the position to which the side plate 18 contacts the plating tub main part 17 is reached if the cylinder 38 for tub opening and closing is operated and the piston 38a is advanced, As shown in drawing 7, the lock member 36 projects, it engages with the height 39 for a lock provided in the upper bed part of the tub opening and closing member 35, and the tub opening and closing member 35 and the side plate 18 are locked.

[0044] 40 is a hinge mechanism for the adjustment for adjusting play between the side plate 18 and the tub opening and closing member 35, The interval after the substrate 19 with which the side plate 18 and the tub opening and closing member 35 of each other were combined via play of a prescribed dimension, the interval of this play was adjusted with the nut 40a, and the side plate 18 was equipped via this hinge mechanism 40 to be plated contacts the packing 20 until it is locked is adjusted.

[0045] The side plate 18 is equipped with the substrate 19 to be plated for the state 18 which opened the above-mentioned tub opening and closing member 35, i.e., a side plate, in the position of C of drawing 6. Drawing 8 and drawing 9 are the figures showing the composition of a plating board mounting mechanism. A plating board mounting mechanism possesses the cylinder 44 for a nail drive fixed to the side plate 18, and the nail 45 for plating board maintenance with which a tip projects in the upper surface of the side plate 18 is being fixed at the tip of the piston 44a of this cylinder 44 for a nail drive so that it may illustrate. The tip is established in the lower surface of this side plate 18 via the spring (not shown) etc. in the nail 46 for plating board maintenance at the lower part of the side plate 18, enabling free projection.

[0046] The member 49 is formed in the rod 50 fixed to the lower end of the cylinder 44 for a nail drive via the spring 51, enabling free sliding, It is provided in one end of this member 49, enabling free rotation of the roller 47, and the nail pressing member 48 which presses said nail 46 for plating board maintenance via the connecting member 52 is connected with the other end. The nail pressing member 48 is ****(ed) by the fulcrum in the pin 53, enabling free rotation. 54 is a contact member which said roller 47 contacts.

[0047] In the plating board mounting mechanism of the above-mentioned composition, the cylinder 38 for tub opening and closing of drawing 6 is operated, and if the side plate 18 is opened as shown in drawing 9, the roller 47 will contact the contact member 54 and will push up the member 49. Thereby, the end of the nail pressing member 48 is pulled via the connecting member 52, and it rotates clockwise focusing on the pin 53. By this nail pressing member 48, this pushes the nail 46 for plating board maintenance. Thereby, this nail 46 for plating board maintenance projects on the surface of the side plate 18 only a prescribed dimension. The nail 45 for plating

board maintenance moves to the prescribed dimension upper part by operating the cylinder 44 for a nail drive. this state — the interval of the nail 46 for plating board maintenance, and the nail 45 for plating board maintenance — the path of the substrate 19 to be plated — the specified quantity — it is large.

[0048]In this state, the substrate 19 which is not illustrated and which was grasped at the tip of a robot arm to be plated is laid in the upper surface of the side plate 18 between the nail 46 for plating board maintenance, and the nail 45 for plating board maintenance. That this substrate 19 to be plated was laid detects by the sensor 33 (refer to drawing 4). The cylinder 44 for a nail drive is operated, the nail 45 for plating board maintenance is moved until it contacts the side edge of the substrate 19 to be plated, and the substrate 19 to be plated is pinched by the nail 46 for plating board maintenance, and the nail 45 for plating board maintenance. Thereby, it is equipped with the substrate 19 to be plated on the side plate 18.

[0049]Then, by operating the cylinder 38 for tub opening and closing of drawing 6, and lengthening the piston 38a, it rotates counterclockwise focusing on the hinge mechanism 37, and the tub opening and closing member 35 is interlocked with it, and the side plate 18 also rotates it counterclockwise. Thereby, the roller 47 separates from the contact member 54, and the member 49 and the connecting member 52 are pushed on the spring 51, and it carries out prescribed dimension descent. Thereby, the nail pressing member 48 rotates counterclockwise focusing on the pin 53, and opens the nail 46 for plating board maintenance. Although the nail 46 for plating board maintenance retreats by this, the tip is projected from the upper surface of the side plate 18 as it can support the outer edge section of the substrate 19 to be plated, and supports the substrate 19 to be plated.

[0050]The side plate 18 closes the opening of the plating tub main part 17 as mentioned above, and the common-law marriage part of the annular packing 20 sticks to the edge surface part of the substrate 19 to be plated, If the space through which the plating liquid 23 surrounded by the shield 22, the substrate 19 to be plated, and the packing 20 flows is formed, will start the pump 14 of drawing 1, and will plate by pouring the plating liquid 23 to this space, but. Since the closed space which pours this plating liquid 23 is not formed unless the side plate 18 is equipped with the substrate 19 to be plated, when the pump 14 is started, the plating liquid 23 will flow out outside. Then, it performs emitting an alarm etc., and even if a starting power supply is supplied to the pump 14 at least, it is made not to start the pump 14 in this example of an embodiment, when it is equipped with the substrate 19 to be plated with the output of the above-mentioned sensor 33, or no is detected and it is not equipped with the substrate 19 to be plated. The plating liquid 23 is supplied in the plating tub 11 in the state where it is not equipped with the substrate 19 to be plated, by this, there is no fear of flowing out of the plating tub 11, and it becomes safe.

[0051]Drawing 10 is a figure showing other examples of composition of the plating tub of the plating device of this invention. In the figure, the portion which attached drawing 1 and identical codes shows a same or considerable portion. This plating tub 11 makes the shield 22 the plating tub main part 17 with the composition which carried out fitting insertion so that it may illustrate. It has composition which carried out fitting insertion of the anode electrode 21, and made the field of the shield 22, and the field of the anode electrode 21 follow the hole 22a for electric field adjustment which made the field of the plating tub main part 17, and the field of the shield 22 continue in respect of the same, and was established in the center section of the shield 22 in respect of the same. And it constitutes so that the space 56 which pours plating liquid may be formed between the side plate 18, the shield 22, and the anode electrode 21 and the substrate 19 to be plated. 55 is an O ring infixed between the inner skin of the hole 22a of the shield 22, and the peripheral face of an anode electrode.

[0052]In the plating tub 11 of composition of being shown in drawing 10, the holes 17a and 17b of a large number along which the plating liquid provided in the vertical section of the grabby tub

main part 17 which a graphic display omits passes are the same as that of drawing 1 and drawing 2. The passage constitution of the plating liquid which supplies plating liquid to the plating tub 11 from the plating circulation tank 25 is the same as the composition shown in drawing 1.

[0053]As mentioned above, by considering the field of the plating tub main part 17, the field of the shield 22, and the field of the anode electrode 21 as the composition which continued in respect of the same, disorder of the flow of the plating liquid which flows through the space between this field and the substrate 19 to be plated is controlled, and a uniform plating film can be formed according to the field of the substrate 19 to be plated.

[0054]As a substrate which performs plating processing with the plating method of a substrate and device concerning this invention to be plated, not only a semiconductor wafer but various substrates which need to perform plating processing can be considered.

[0055]

[Effect of the Invention]As explained above, according to each claim, the following outstanding effects are acquired.

[0056]Since it plates fluctuating the pressure of the plating liquid in a plating tub, and switching the flow direction of this plating liquid according to the invention according to claim 1, An enter lump of the plating liquid to an omission, and the detailed hole and slot on the air bubbles from a detailed hole or a slot which were formed in the plating side of a substrate to be plated is good, and can form the uniform plating film of thickness more.

[0057]According to the invention according to claim 2, the uniform plating film of thickness can be formed, without being influenced by the size in the plating side of a substrate to be plated by forming so that plating liquid may flow through a plating liquid flow channel in parallel with the plating side of a substrate to be plated.

[0058]According to the invention according to claim 3, since the plating side of a substrate to be plated is held with the posture leaning to the vertical plane, particle does not adhere to a plating side.

[0059]Since it plates with the state where formed a means to make a substrates face to be plated incline so that it may turn to a top in 30 degrees from a vertical, and the substrate to be plated was made to incline in this range according to the invention according to claim 4, The air bubbles of the fine hole of the plating side of a substrate to be plated fall out easily, plating liquid flows in to the inside of a fine hole, and a plating film can be formed also in the internal surface. There is also no adhesion in the plating side of the substrate of particle to be plated.

[0060]According to the invention according to claim 5, the edge surface of the substrate with which this side plate was equipped where the opening of a plating tub main part is closed with a side plate to be plated contacts packing, Since the plating liquid flow channel which pours plating liquid in parallel to the plating side of a substrate to be plated is formed between this plating tub main part and this substrate to be plated, It becomes possible for the plating liquid which flows into parallel to contact only the plating side exposed to the opening of the plating tub main part of a substrate to be plated, to contact plating liquid at other portions other than this plating side, and for there to be no inconvenience — plating is performed — and to form the uniform plating film of thickness only in a plating side.

[0061]Since it is made not to supply plating liquid to a plating tub when it judges that it is not equipped with the substrate to be plated from the output of a sensor according to the invention according to claim 6, Since plating liquid is not poured to a plating tub in the state where a closed space which pours plating liquid is not formed between the accidents by plating liquid being supplied in the state where it is not equipped with the substrate to be plated, for example, a plating tub main part and a substrate to be plated, the danger of plating liquid flowing out outside disappears.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.** shows the word which can not be translated.**

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]It is the plating method of a substrate which accommodates a substrate to be plated into a sealed plating tub, introduces plating liquid in this plating tub, and plates on a plating side of said substrate to be plated, A plating method of a substrate characterized by plating fluctuating a pressure of said plating liquid and switching a flow direction of this plating liquid.

[Claim 2]It is a plating device of a substrate which accommodates a substrate to be plated into a sealed plating tub, introduces plating liquid in this plating tub, and plates on a plating side of said substrate to be plated, A plating device of a substrate characterized by forming the channel so that said plating liquid may flow in parallel with a plating side of said substrate to be plated.

[Claim 3]It is a plating device of a substrate which accommodates a substrate to be plated into a sealed plating tub, introduces plating liquid in this plating tub, and plates on a plating side of said substrate to be plated, A plating device of a substrate constituting so that a plating side of said substrate to be plated may be held with a posture leaning to a vertical plane.

[Claim 4]A plating device of a substrate plating with the state where formed a means to make a plating side of said substrate to be plated incline in a plating device of the substrate according to claim 2 so that it may turn to a top in 30 degrees from a vertical, and this substrate to be plated was made to incline in this range.

[Claim 5]In a plating device of a substrate given in any 1 paragraph of claims 2 thru/or 4, said plating tub possesses a side plate which opens and closes an opening of a plating tub main part and this plating tub main part, and maintaining structure holding a substrate is provided in this side plate, and. Form annular packing in an opens part of this plating tub main part, and an edge surface of a substrate with which this side plate was equipped where an opening of said plating tub main part is closed with said side plate to be plated contacts said packing, A plating device of a substrate constituting so that a plating liquid flow channel which pours said plating liquid in parallel to a plating side of said substrate to be plated may be formed between this plating tub main part and this substrate to be plated.

[Claim 6]A plating device of a substrate characterized by comprising the following.

A sensor which detects wearing of a substrate to be plated in a plating device of a substrate of a statement at said plating tub in any 1 paragraph of claims 2 thru/or 5.

A means kept from supplying plating liquid to said plating tub at least when it judges that it is not equipped with a substrate to be plated from an output of this sensor.

[Translation done.]